JPRS 83434

9 May 1983

China Report

ECONOMIC AFFAIRS

No. 336

ENERGY: STATUS AND DEVELOPMENT --XVI

FBIS FOREIGN BROADCAST INFORMATION SERVICE

NOTE

JPRS publications contain information primarily from foreign newspapers, periodicals and books, but also from news agency transmissions and broadcasts. Materials from foreign-language sources are translated; those from English-language sources are transcribed or reprinted, with the original phrasing and other characteristics retained.

Headlines, editorial reports, and material enclosed in brackets [] are supplied by JPRS. Processing indicators such as [Text] or [Excerpt] in the first line of each item, or following the last line of a brief, indicate how the original information was processed. Where no processing indicator is given, the information was summarized or extracted.

Unfamiliar names rendered phonetically or transliterated are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear in the original but have been supplied as appropriate in context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by source.

The contents of this publication in no way represent the policies, views or attitudes of the U.S. Government.

PROCUREMENT OF PUBLICATIONS

JPRS publications may be ordered from the National Technical Information Service, Springfield, Virginia 22161. In ordering, it is recommended that the JPRS number, title, date and author, if applicable, of publication be cited.

Current JPRS publications are announced in Government Reports Announcements issued semi-monthly by the National Technical Information Service, and are listed in the Monthly Catalog of U.S. Government Publications issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

Correspondence pertaining to matters other than procurement may be addressed to Joint Publications Research Service, 1000 North Glebe Road, Arlington, Virginia 22201.

JPRS 83434

9 May 1983

CHINA REPORT

ECONOMIC AFFAIRS

No. 336

ENERGY: STATUS AND DEVELOPMENT --XVI

CONTENTS

NATIONAL POLICY

In Coordinating Nationwide Build-Up, Power Industry Has Its Work Cut Out for It
(Xiao Genxing; XIANDAIHUA, 25 Jan 83) 1

POWER NETWORK

Briefs

Baogang Power Plant Basically Completed 6
Hubei Power Transmission Line 6
Future 500KV Power Line 6
Gezhouba-Wuchang 500KV Line 6

HYDROPOWER

Plan To Develop Lancang Jiang's Huge Hydropower Potential Unveiled
(Cai Yaozhong; SHUILI FADIAN, 12 Dec 82) 8

Groundwork Laid for Construction of Big Manwan Project on the Lancang Jiang
(YUNNAN HUABAO, No 1, 1983) 16

Xi'er He Cascade Hydropower Project Makes Steady Progress
(Zhu Xiangwei; YUNNAN HUABAO, No 1, 1983) 20

Lubuge Project Enters Final Construction Preparation Stage
(YUNNAN RIBAO, 25 Mar 83) 24

Planners Determine Giant Ertan Project To Be Technically Feasible
(RENMIN RIBAO, 19 Mar 83) 25

Status Report on Tongjiezi Hydroelectric Project
(Zhang Jihua; SHUILI FADIAN, 12 Dec 82) 26

Guangxi, Guangdong Hydropower Construction
(SHUILI FADIAN, 12 Feb 83) 29

Economic Considerations Spur Renewed Efforts To Exploit Sichuan's Hydraulic Resources
(Shui Xuan; SICHUAN RIBAO, 15 Jan 83) 33

Accelerating Sichuan's Buildup of Small-Scale Hydroelectric Power
(SICHUAN RIBAO, 15 Jan 83) 36

Army of Construction Workers Converges on the Hongshui He
(Wang Dehua; XIANDAIHUA, 25 Mar 83) 38

Briefs

Sichuan Small-Scale Hydropower 40
Nanya He Progress Report 40
Taipingwan Earthwork Completed 40

THERMAL POWER

Problems in Design of Thermal Power Plants Examined
(Wang Jiansan, et al.; DIANLI JISHU, 5 Oct 82) 41

Flyash Quality, Comprehensive Utilization Analyzed
(Luo Shuofu; DIANLI JISHU, 5 Oct 82) 54

Suggestions on Use of Large-Capacity, High-Parameter Thermoelectric Generators
(Qiu Changqing; DIANLI JISHU, 5 Oct 82) 62

COAL

Industry Girds Itself To Meet Heavy 1983 Production Demands
(Yu Hongen; SHIJIE MEITAN JISHU, Jan 83) 69

Minister Unveils Grand Strategy To Revamp Coal Industry
(Gao Yangwen; MEITAN KEXUE JISHU, 25 Oct 82) 82

Development of New Open-Pit Mines Could Solve Nation's Energy Shortage by 1990's
(Wu Zhixiang; SHIJIE MEITAN JISHU, Feb 83) 88

Ways To Accelerate Growth of Yunnan Coal Industry Suggested
(He Peilin; YUNNAN RIBAO, 20 Jan 83) 93

Foreign Cooperation Planned for Hainan Coal Mine
(ZHONGGUO XINWEN SHE, 23 Mar 83) 96

Combustion Characteristics of Chinese Steam Coal Studied
(Lin Hao, et al.; MEITAN KEXUE JISHU, 25 Oct 82) 97

Methods of Increasing Coal Recovery Rate Discussed
(Rui Susheng; SHIJIE MEITAN JISHU, Dec 82) 106

New Railroads, Port Facilities, Slurry Pipelines Planned for Shanxi
(SHANXI RIBAO, 19 Mar 83) 110

Joint China-Japan Coal Liquefaction Project Completed
(XINHUA, 21 Apr 83) 112

Ways To Increase Economic Benefit of Coal Industry Enterprises
(Li Shaoxun, Ji Zhongshi; JISHU JINGJI YU GUANLI YANJIU, 31 Dec 82) 114

Briefs
- New Coal Railroads, Piers 120
- New Nei Monggol Mines 120
- Henan Coal Production 120
- Shandong Coal Production 120
- Guangdong Coal Production 120
- New Anhui Coal Mines 121

OIL AND GAS

Crude Oil Production Stable at 100 Million Tons a Year
(Chen Zhongyong; JINGJI RIBAO, 5 Feb 83) 122

Ways To Accelerate Natural Gas Exploration and Development Proposed
(Qin Tongluo; SHIYOU KANTAN YU KAIFA, No 1, 1983) 124

Prospects Said Bright for Exploiting Qaidam Oil, Gas
(Qinghai Provincial Service, 17 Mar 83) 129

Briefs
- Natural Gas Power Generation 130

NUCLEAR POWER

Details of Nation's First Nuclear Power Plant Presented
(Feng Zejun; XIANDAIHUA, 25 Jan 83) 131

CONSERVATION

Briefs
- Crude Oil Conservation 137

NATIONAL POLICY

IN COORDINATING NATIONWIDE BUILD-UP, POWER INDUSTRY HAS ITS WORK CUT OUT FOR IT

Beijing XIANDAIHUA [MODERNIZATION] in Chinese Vol 5, No 1, 25 Jan 83 pp 1-2

[Article by Xiao Genxing [5135 2704 5281] of the Ministry of Water Conservancy and Electric Power: "The Enormous Task of the Electric Power Industry"]

[Text] We Must Quadruple or More

The 12th National Party Congress proposed the strategic plans for economic buildup during the next 20 years up to the end of this century. This has brought about an even higher demand upon the electric power industry. Electric power is the vanguard of the national economy. To realize a quadrupling of the total production value in industry and agriculture by the year 2000 requires electric power to quadruple or more. Widely using electricity will not only effectively stimulate mechanization and automation of the production process, it will also improve labor productivity and conditions and it can greatly reduce the total consumption of energy. In industrial production, using electricity can conserve over half of the energy consumed by using other forms of energy. The use of electric motors can realize a savings of 20 to 25 percent in cost than using oil motors.

The strategic goals proposed by the 12th National Congress are not only rich in revolutionary spirit, they also coincide with the scientific attitude. In view of the history of the electric power industry, quadrupling output in the next 20 years is entirely possible. Our output of electricity increased from 77.3 billion kilowatt-hours in 1967 to 309.3 billion kilowatt-hours in 1981, taking only 14 years to quadruple. The installed capacity for generating electricity increased from 17 million kilowatts in 1966 to 69 million kilowatts in 1981. Quadrupling only took 15 years. Abroad, the United States grew from 300 billion kilowatt-hours in 1947 (equivalent to our output of electricity in 1980) to 1.25 trillion kilowatt-hours in 1966. Quadrupling took 19 years. The Soviet Union grew from nearly 300 billion kilowatt-hours in 1960 to 1.2 trillion kilowatt-hours in 1978, taking 18 years. It can be seen that it is entirely possible to quadruple our electric power in the next 20 years. In the future, estimating on the basis of the possible rate of growth of the total annual production value in industry and agriculture, the rate of growth of the electric power industry during the "Seventh Five-Year Plan" period should reach 6.75 percent. Ten years later it should reach 9.6 percent before the requirements in national economic development can be satisfied. In this way, by the year 1990, the output of electric power should reach 520 billion kilowatt-hours, and the capacity of power generating equipment should reach 110 million to 120 million kilowatts. By the year 2000, the output of electricity should reach 1.3 trillion kilowatt-hours, and the capacity of power generat ing equipment must reach 240 to 260 million kilowatts. If we consider the fact that foreign and domestic power production or the rate of growth of consumption is always ahead of the rate of growth of the national economy, if we consider the fact that we must change the situation of a shortage of electricity for 13 continuous years and that we must improve and renovate some old and outdated equipment, then under allowable conditions, it is necessary and rational for the scale of buildup of electricity to be appropriately enlarged and the growth rate should be faster.

To realize the above goals, the power industry must manage and use well the more than 60 million kilowatts of currently available equipment, it must also consider the following questions in the buildup of electric power.

Developing Hydroelectricity as a Priority

Hydraulic resources are natural renewable forms of energy and are wasted if not developed and utilized. Developing and utilizing hydraulic resources early can conserve the consumption of coal, oil, gas and such fuels, reduce the pressure on transportation, and also produce comprehensive benefits in flood prevention, irrigation, navigation and aquatic culture. China's hydraulic resources are extremely rich. The theoretical reserves amount to 680 million kilowatts. The amount that can be exploited also amounts to 370 million kilowatts. The annual output of electricity is 1.9 trillion kilowatt-hours. The amount presently developed and utilized, calculated by volume, constitutes only 5.5 percent of the exploitable amount. The annual output of hydroelectricity constitutes 19.4 percent of the total amount of output of electricity. The development of hydroelectricity has a bright future.

According to China's financial and material strength, the present arrangement by the state is to select "rich mines" of hydroelectricity for development as a priority. The emphasis is on the development of the upper and middle reaches of the Huang He, the Hongshui He river valley and the mainstream and estuaries of the middle and upper reaches of the Chang Jiang to build a number of large- and medium-scale hydroelectric power stations that are closer to the centers of power loads, that are in regions where loss due to flooding is less, and where the amount of construction is small but quick results can be realized. The buildup of the hydroelectricity bases of the Jinsha Jiang, Yalong Jiang, Dadu He, Wu Jiang, the middle reaches of the Lancang Jiang, western Hunan and Fujian-Zhejiang-Jiangxi must be carried out one after the other. In the northeast and such regions, we must decide to quickly develop hydraulic resources that have not been developed to coordinate with the improvement of the safe and economic operation of thermoelectric power plants. In the near-term, we must concentrate funds, materials and manpower, and accelerate the progress in the construction of a number of large- and medium-scale hydroelectric power stations on a scale of 100 million kilowatts now under construction. For example, we must strive to quickly install the generators and quickly begin production at the hydroelectric power stations of Gezhouba in Hubei (2,715,000 kilowatts), Longyangxia in Qinghai (1.28 million kilowatts), Baishan in Jilin

(900,000 kilowatts), Ankang in Shaanxi (800,000 kilowatts), Dongjiang in Hunan (500,000 kilowatts), Tongjiezi in Sichuan (600,000 kilowatts), Huangni He in Yunnan (560,000 kilowatts), Wan'an in Jiangxi (400,000 kilowatts), Dahua on the Hongshui He (400,000 kilowatts), and Tianshengqiao Basuo (800,000 kilowatts) under the prerequisite of guaranteeing quality. We should strive to build a number of hydroelectric power stations of over 1 million kilowatts during the "Sixth Five-Year Plan" and the "Seventh Five-Year Plan" periods, including Shuikou in Fujian, Yantan in Guangxi, Geheyan in Hubei, Pengshui (or Baozhusi) in Sichuan, Wuqiangxi in Hunan, Heishanxia (or Daliushu) on the upper reaches of Huang He, and Tianqiao Bapan on the Hongshui He. At the same time, we must mobilize the enthusiasm of the localities, and stimulate them to build medium and small hydroelectric power plants by themselves. In this way, it is possible with efforts to increase the percentage of the annual amount of output of hydroelectricity to over 20 percent of the total output of electric power within 10 years. Developing hydroelectricity as a priority not only is the key point in current electric power buildup, it is also a strategic measure to solve our energy problem for some time into the future.

Accelerating the Buildup of Coal and Electric Power Bases

China's coal resources are very abundant. The known reserves amount to 650 billion tons, next only to the United States and the Soviet Union, ranking third in the world. Our coal resources are not only quantitatively abundant, the coal quality is better, the varieties are complete, and regional distribution is broader. In the geological reserves of coal throughout the nation, coal for power use constitutes 45.8 percent. This determines that our future development of thermal electric power plants still must implement the principle establishing ourselves on burning coal.

To reduce the pressure on railroad transportation and prevent urban pollution, China will continue to accelerate the buildup of coal and power bases as the large coal fields with a large reserve at a shallow depth and thick coal seams are developed. We will build a group of power stations of a million and even several million kilowatts in the coal mining regions with rich coal resources, Shanxi, the three eastern leagues in Nei Monggol, Huainan and Huaibei in Anhui, western Henan, southern Shandong, Weibei in Shaanxi, and Liupanshui in Guizhou, and gradually form a strong power center to transmit electricity to other places. At the same time, in regions where coal resources are insufficient but the power consumption loads are relatively centralized, a group of large-scale thermal power plants will be built according to the possibilities for transporting fuel. During the "Sixth Five-Year Plan" period, we have already begun to build thermal power plant projects with a total scale reaching 13 million kilowatts. The large-scale projects with an installed capacity of about 1 million kilowatts are mainly Douhe in Hebei, Datong and Suoxian in Shanxi, Yuanbaoshan in Nei Monggol, Jianbi and Xuzhou in Jiangsu, Yaomeng and Jiaozuo in Henan, Qinling in Shaanxi, Qinghe in Liaoning, Shajiao in Guangdong, the three plants in Harbin and Hulan Ergi in Heilongjiang, Huainan in Anhui and Zouxian in Shandong. They are all under intense construction. During the "Seventh Five-Year Plan" period, we will begin building a number of thermal power plants with installed capacity of about 1.2 million kilowatts.

To improve the economic benefits of thermal power plants and hasten the rate of development of the power industry, it is necessary to greatly develop large generators. According to our nation's equipment manufacturing capability, during the "Sixth Five-Year Plan" period, we should strive to install more single generators of 200,000 to 300,000 kilowatts. During the "Seventh Five-Year Plan" period and later, we must strive to install more generators of 300,000 to 600,000 kilowatts. According to the need for heat loads, we should actively develop thermal power plants that can provide both electricity and heat to conserve fuel.

Actively Developing Nuclear Energy and Other New Forms of Energy

The use of energy by man has gone through the period of using grass and wood, the period of using coal and the period of using petroleum and natural gas. Now, man has entered the period of using nuclear energy. The use of nuclear energy to generate electricity signifies that the power industry has entered a new stage. Our nation is vast and over 60 percent of the coal resources are concentrated in North China. Over 70 percent of hydraulic resources are concentrated in the southwest. The development of nuclear power stations in coastal regions that lack coal and that have less hydraulic power can no longer be delayed. The nuclear power station is technically mature. Production is safe. At present, the world already has the experience of operating nuclear power stations with over 160 million kilowatts. Our nation also has nuclear resources. Therefore, the state has decided to quickly begin the construction of nuclear power stations. The first 300,000-kilowatt nuclear power station to be designed and built by our nation itself will be built at Qinshan in Zhejiang. Preliminary work is being carried out to plan several nuclear power stations in South China, East China and North China. During the "Sixth Five-Year Plan" period, we should strive to begin the buildup of nuclear power in Guangdong. Several key nuclear power stations should be developed as key projects. Besides providing supplementary energy, more importantly we should continue to accumulate experience to lay a good foundation for gradually establishing a complete nuclear power industry system in the future.

China's geothermal energy, wind energy and tidal energy resources are also very abundant. Some regions have already built small-scale experimental power stations. A lot of experience has been obtained in test operations. The larger scale Yangbajing Geothermal Power Station in Xizang is being intensively built. Generation of electricity using methane has also realized some achievements. Jiangsu already has several generators using methane to generate electricity and they are being test operated. In the future, we still must start from scientific research, continue to conduct test points in utilizing new energy, continue to summarize experience, and then popularize the experience according to the degree of maturity and by suiting measures to local circumstances, and gradually realize diversification of energy sources for generating electricity.

Greatly Developing Large Power Grids

The development of large power grids is a law in developing electric power. Large power grids are favorable to transmitting electricity from large hydroelectric power stations and thermal power plants at large mining pits to power consumption centers far away. They are favorable to the rational utilization of dynamic energy resources. They benefit the use of large generators, they can hasten the rate of development, reduce construction cost and conserve fuel. They enable generators to serve as mutual backup and they improve the safety and reliability of power supply. They benefit the development of economic dispatching between hydroelectric power and thermal electric power plants and continued improvement of economic benefits. They can also greatly reduce the pressure on transporting fuel for generating electricity. In recent years, our nation's construction of power grids has developed by a greater extent. The Sichuan Power Grid and the Guizhou Power Grid in the southwest, the Shanxi, Hebei and Beijing-Tianjin-Tangshan Power Grid in North China, and the Hebei and Henan Power Grid in Central China, have all been linked in operation. In particular, our first 500,000-volt ultrahigh voltage transmission line from Pingdingshan in Henan to Wuhan has begun operation. It has provided technology and experience to further develop large power grids. To adapt to the needs in developing electric power, the several 500,000-volt lines of Yuan (Baoshan), Jin (zhou), Liao (yang) in the northeast, the Datong-to-Beijing line in North China, the Ge (zhou)-Wu (chang) line and the Ge (zhouba)-Shuang (he) in Central China and the Huainan-to-Shanghai line in Eastern China are being intensively constructed. Feasibility studies are being conducted for the joint operation of the Northwest and North China power grids, the Central China and Eastern China power grids, and the Guangxi and Guangdong power grids. As the large power grids continue to develop, hydroelectricity of the upper and middle reaches of the Huang He will be transmitted to Beijing and Tianjin, hydroelectricity of Gezhouba will be transmitted far away to Shanghai, hydroelectricity of the Hongshui He will be directly transmitted to Guangdong. These will greatly change the present situation of shipping northern coal to the south, shipping western coal to the east, and transferring eastern electric power to the west. The development of large power grids will surely and gradually form a nationwide joint power grid. Therefore, experiments and research in the technology of long-distance transmission of ultrahigh voltage alternating current of over 500,000 volts and long-distance transmission of ultrahigh voltage direct current have already been included in the daily agenda.

9296
CSO: 4013/141

BRIEFS

BAOGANG POWER PLANT BASICALLY COMPLETED--The No 2 generator of the Baogang Power Plant was completed yesterday and began to generate electricity, supplying electricity to the East China Grid. The Baogang Power Plant has now been basically completed. This generator has an installed capacity of 350,000 kilowatts, the same as that of the first generator. After the Baogang Power Plant has been /completely/ finished and goes on stream, it will ease the power shortage in the East China region considerably. The No 1 generator of the Baogang Power Plant joined the grid in April 1982 and has now generated 1.5 billion kilowatt-hours of electricity and earned profits of more than 13 million yuan. /Text/ /Beijing GUANGMING RIBAO in Chinese 17 Mar 83 p 1/

HUBEI POWER TRANSMISSION LINE--Wuhan, 19 Mar (XINHUA)--The 500-kilovolt ultrahigh-tension power transmission line between Gezhouba and Wuchang was completed in early March, more than 3 months ahead of schedule. The 333-kilometer long power transmission line is another main line added to the central China power grid after the two 500-kilovolt transmission lines from Pingdingshan to Wuchang and from Gezhouba to Shuanghe. [Beijing XINHUA Domestic Service in Chinese 0734 GMT 19 Mar 83]

FUTURE 500KV POWER LINE--The first ultrahigh-tension 500-kilovolt powerline in East China will soon be built in Anhui. The work of organizing construction and reviewing designs has been completed and ground will be broken in May. This ultrahigh-tension power transmission line will have a total length of 250 kilometers. A major engineering and construction project approved by the State Planning Commission for 1983, the line will play an important role in the building of the four modernizations in the East China region. [Text] [Shanghai JIEFANG RIBAO in Chinese 9 Mar 83 p 3]

GEZHOUBA-WUCHANG 500KV LINE--Wuhan, 19 Mar (XINHUA)--A 333-kilometer ultrahigh voltage electric power transmission line has been put up from Gezhouba, China's biggest hydraulic engineering project, to Wuchang in Wuhan city, capital of Hubei Province. Construction of the 500-kilovolt transmission line was completed earlier this month, 3 months ahead of schedule. The project is part of a mammoth power network being built in central China. Two other 500-kilovolt lines were put up earlier—one from Gezhouba to Shuanghe and the other from Wuchang to Pingdingshan. Pingdingshan is a major coal center in neighboring Henan Province. Three electricity generating units with a total capacity of 465,000 kilowatts are on line at the first hydroelectric power station at Gezhouba, which is on the main stream of the Chang Jiang near Yichang City, Hebei Province. Upon completion, the entire project will have a total generating [installed] capacity of 2,715,000 kilowatts, according to an earlier news report. [Text] [Beijing XINHUA in English 1417 GMT 19 Mar 83]

CSO: 4010/54

PLAN TO DEVELOP LANCANG JIANG'S HUGE HYDROPOWER POTENTIAL UNVEILED

Beijing SHUILI FADIAN /WATER POWER/ in Chinese, No 12, 12 Dec 82, pp 4-8

/Article by Cai Yaozhong /5591 3852 1813/ of the Kunming Surveying and Design Institute of the Ministry of Water Conservancy and Electric Power: "Another 'Rich Mine' of Hydraulic Energy in China--the Cascade Hydroelectric Power Stations of the Middle and Lower Courses of the Lancang Jiang"/

/Excerpts/ To fully create a new situation in the buildup of socialist modernization, the Party Central Committee established for us the glorious strategic goal, the key strategic points and the strategic steps for the end of this century at the 12th Party Congress. Energy and transportation are one of the three main strategies, the key factors that will decide whether the total annual production value of the nation's industry and agriculture can quadruple. Therefore, under the prerequisite of continuing to improve economic benefits, how to push electric power forward is the glorious and difficult task of the broad number of workers in the electric power profession in our nation. China's hydraulic energy resources are rich. The leading comrades of the Central Committee and the Ministry of Water Conservancy and Electric Power have always advocated accelerating the build-up of hydroelectricity, suiting measures to local circumstances, and "gradually placing the main emphasis on hydroelectricity." This is an important principle in China's electric power construction. The purpose of this article is to introduce to the reader a hydroelectric power base which will be gradually developed in the future--the cascade hydroelectric power stations of the middle and lower courses of the Lancang Jiang--so that we may determine indirectly the broad prospects in the development of hydroelectric power in the southwestern region.

I. The Hydraulic Energy Resources in Yunnan Province and the Cascade Hydroelectric Power Stations of the Middle and Lower Courses of the Lancang Jiang

The hydraulic energy resources in Yunnan Province are rich. The theoretical reserve is 103.6 million kilowatts, constituting 15.3 percent of the whole nation and ranking third in the nation following Xizang and Sichuan. The installed capacity that can be developed and utilized is 71 million kilowatts, equivalent to an annual output of 394 billion kilowatt-hours, or 18.8 and 20.5 percent respectively of the national installed capacity and output.

The hydraulic energy resources in Yunnan Province consist mainly of the five large water systems of the Jinsha Jiang (the segment of the river below Dukou on the middle course bordering, Sichuan Province; the resources of that segment constitute one-half), the Lancang Jiang, Nu Jiang, Hong He, and the Nanpan Jiang. The water system is characterized by a large reserve, a high potential for development and utilization and good conditions for development. They are manifested in the following: (1) The fall of the river is large and the volume of flow is abundant; (2) The topographical and geological conditions are favorable, and good sites for regulatory reservoirs and dams can be found; (3) The relative loss to flooding by the reservoir is small; and (4) The targets for development are singular and their effect upon the ecological balance is quite small. Therefore, some leading comrades of the former Ministry of Electric Power mentioned several times that "the hydraulic energy resources in Yunnan are the best in the nation" when they conducted a hydropower inspection in Yunnan last year. This comment is well founded. Of course, there are unfavorable conditions, mainly the inconvenience of transportation, the geographic positions of the large rivers are slightly towards the west and the north. The distribution of major hydroelectric power stations already built, being built and planned in Yunnan Province are shown in Figure 1 /map insert/.

Among the mainstreams of the five large water systems in Yunnan Province, the Lancang Jiang has the best conditions for development. The river runs through the western part of Yunnan. It is an international river running north to south, becoming the Mekong River after leaving China. The river segment inside Yunnan Province is 1,200 kilometers long, the fall is 1800 meters and it controls a river valley area of 160,000 square kilometers. The average flow over many years is 1,900 cubic meters/second. Initial plans call for the establishment of 15 cascade stations. Tuoba is the main regulatory reservoir with six cascade stations along the river segment of the upper reaches. The river segment of the middle course has five cascade stations centered around the Xiaowan high dam and large reservoir. The Nuozhadu Reservoir is the main reservoir with four cascade stations along the river segment of the lower course. When the 15 cascade stations operate jointly, the total installed capacity will be 20.73 million kilowatts, the guaranteed output will be 9.58 million kilowatts, and the annual output of electricity will be 108.8 billion kilowatt-hours. The plane and vertical positions of the cascade power stations are shown in Figure 1 and Figure 2 /map and profile insert/.

Among these 15 cascade stations, the nine stations along the river segments of the middle and lower courses have the best geographical locations and the best conditions for development. Dam sites are mostly hard igneous rock or metamorphic sandstone and the reservoir areas do not seep. The topography includes two large regulatory reservoirs, the Xiaowan and Nuozhadu reservoirs, with a total capacity of about 23 billion cubic meters. The elevations are high and the storage capacities are large. The total installed capacity of the nine cascade stations reaches 12.7 million kilowatts with a guaranteed output of 5.9 million kilowatts generating 66 billion kilowatt-hours of electricity a year. The area of cultivated land to be flooded is only 83,000 mu and a population of only 46,000 will be evacuated. The amount of concrete and investment per unit kilowatt are 2.2 cubic meters and 1,020 yuan respectively. The economic index of energy is comparable to the two hydroelectric power bases on the upper and middle course of the Huang He and the Hongshui He but the loss due to flooding is much less. The accompanying table lists the major indices of these three hydroelectric power bases for analysis and comparison. It shows that the hydroelectric power base of the middle and lower reaches of the Lancang Jiang is indeed another "rich mine" of China's hydraulic energy resources. This entirely coincides with the actual situation.

II. First Phase Construction--Manwan Hydroelectric Power Station

Since surveying and planning for the middle and lower courses of the Lancang Jiang began in 1975, the "Report on the Development of the Middle Course of the Lancang Jiang," the "Report on Planning the Middle Course of the Lancang Jiang," and a surveying report for the lower course were proposed one after the other. They were reviewed by the former Ministry of Electric Power Industry and it was determined that the Manwan Power Station would be the first phase construction project. In 1980, the dam selection report was proposed and the dam site selected. In 1981, the feasibility report for Manwan was proposed and the proposal for the preliminary design was scheduled for 1983 or the first half of 1984.

The Manwan Power Station is located in Yun County on the middle course of the Lancang Jiang. Straight-line distances from Kunming and Dukou are 230 kilometers and 250 kilometers respectively. The installed capacity of the power station is 1 million kilowatts and the guaranteed output is 330,000 kilowatts. Annual electricity output is 5.48 billion kilowatt-hours and the total investment required will be about 1 billion yuan. If the upper course is regulated by the Xiaowan Reservoir, the installed capacity can reach 1.5 million kilowatts and guaranteed output will reach 668,000 kilowatts with an annual output of 7.13 billion kilowatt-hours of electricity. The reservoir will flood only 5,620 mu of cultivated land and require the relocation of only 3,340 people. The topographical and geological conditions of the area at the site of the project are good. The base rock is mainly dacite and dacite-tuff lava. The pressure resistance of the rock is strong. The alluvial layer of the riverbed is thin, only 2 to 7 meters, and the basic intensity of earthquakes is not high, only 6 on the seismic scale. The work site in the dam area is wide and a national defense highway runs through it. The economic index of energy, the loss due to flooding, and the conditions for development, when compared to those of similar scale domestic power stations already built and planned, are all very superior. Therefore, the Yunnan Provincial People's Government and the Ministry of Water Conservancy and Electric Power strongly emphasize the development of the Manwan Power Station. The leading comrades of the province and the ministry have inspected the site many times and have asked our institute to accelerate survey and design work on Manwan. The provincial committee leadership has also given a lot of support and made a lot of arrangements to solve problems related to the building of that power station, such as rerouting highways, relocating people for the reservoir, and building the Western Yunnan Cement Plant.

Yunnan Province already has experienced an increase in the power load, its phosphate rock resources, with reserves topping the whole nation, are rich, the conditions in the mines are good, and there is already a considerable production and technical foundation. If cheap electricity from the Manwan Hydroelectric Power Station, including seasonal electric power, can be utilized to satisfy the needs of the electrolytic yellow phosphorus industry that consumes a lot of electricity (about 16,000 kilowatt-hours of electricity are consumed per ton), and if the yellow phosphorus can be processed to become highly concentrated phosphate fertilizer for export, the burden on rail transportation will be reduced and shipping costs can be saved (exporting 1 ton of yellow phosphorus is equivalent to shipping 10 tons of phosphate rock). At the same time, it has major significance in reducing the cost of phosphate fertilizers and stimulating increased output of food grains. Therefore, to develop Yunnan's industry and agriculture, to meet the living needs of the people, and to support the supply of electricity needed to produce phosphate fertilizers in agricultural production throughout the nation, we should try to start building the Manwan Hydroelectric Power Station at the end of the "Sixth Five-Year Plan" or the beginning of the "Seventh Five-Year Plan" and begin generating electricity around the year 1993.

III. Xiaowan Hydroelectric Power Station Is the Key to Developing the Cascade Power Stations Along the Middle and Lower Courses of the Lancang Jiang

The Xiaowan Power Station is the second of nine cascade stations along the middle and lower courses of the Lancang Jiang. Including its own cascade, its regulation of flow utilizes a total fall of 736 meters. The dam site is below the confluence of a large tributary, the Yangbi Jiang. The dam forms a large two-pronged reservoir (the situation at Nuozhadu on the lower course is the same, therefore the reservoir capacity is also larger). The capacity reaches 15.6 billion cubic meters. With the supplementary flow from melting snow from the upper course of the Lancang Jiang and from some regions of the tributaries and forest regulation, the volume of water is more even and stable, and partial multiple-year regulation can be carried out. This is rare in the southwest region where the river valleys are narrow. Geological studies of drilled holes of over 4,000 meters and massive prospecting of pits over several years show that the geological conditions of the dam site are good. The main lithological character is gneiss. The rocks are hard and exposed. The alluvial layer of the riverbed is 17 to 22 meters thick, the basic intensity of earthquakes is 6 on the scale. The reservoir area consists mainly of metamorphic rock. Investigation shows that it will not seep. Therefore, in 1980 at the Manwan dam selection meeting and in further geological work later on, everyone believed the Xiaowan cascade possessed conditions for building a tall dam and a large reservoir. In addition, the relative loss due to flooding at the Xiaowan cascade station is not very large. According to preliminary investigation, about 35,400 mu of cultivated land will be flooded and a population of 25,380 will have to be relocated. There is a sizeable construction site downstream from the dam. There is a newly built highway of about 50 kilometers leading out, and the conditions for construction are also good.

The dam height of the Xiaowan Power Station is about 300 meters. The amount of concrete to be used will reach 8 million cubic meters. It is an engineering project that is considered relatively difficult among world standards. We must exert efforts to do the preliminary work well and conscientiously execute the work. But its gain is also very large. The scale of its own installed capacity reaches 3.2 million kilowatts, its guaranteed output will be 1.59 million kilowatts, its annual output of electricity will be 16.7 billion kilowatt-hours, and at the same time, it will allow the guaranteed output of the seven cascade power stations of Manwan and others on the lower course to increase by multiples. The capacity of agricultural machinery and the annual output of electricity will also increase by more than 30 percent, and it will bring about benefits in the continued construction of cascade stations to cut the volume of flow during flood discharge and the volume of flow when diverting peak floodwaters. Therefore, Xiaowan Power Station will act as the head power station (reservoir) of the cascade stations in the middle and lower courses of the Lancang Jiang. In the order of development of the cascade stations, it is recommended that they be developed after Manwan. That would be rational. To avoid capital accumulation for such a huge project and to improve economic results, our design and arrangement of construction should allow some of the generators to begin production and to produce benefits when the construction of the dam has reached the stationary water level before actual completion of the dam. During the last 20 years in the Soviet Union, no less than 10 large projects with an installed capacity of about 28 million kilowatts have used this type of simultaneous construction and development of benefits. This experience is worth learning.

IV. We Suggest Continuous Cascade Development for the Stations on the Middle and Lower Courses of the Lancang Jiang

The 12th Party Congress emphatically pointed out that quadrupling the total annual production value of the nation's industry and agriculture must be realized "under the prerequisite of continuing to improve economic benefits", and it proposed "to shift all economic work towards the path centered around the improvement of economic benefits." In our hydroelectric power sector, this must be manifested in carrying out economical operation and dispatching of power stations well, handling the preliminary survey and design work of the power station well, shortening the construction period, and exerting efforts to reduce the construction cost. This writer believes that correctly selecting the point of the power source, rationally arranging the procedures for the development of hydroelectric power stations, and drawing up stable long-range plans have important significance. They can be said to be the most important link to improve economic benefits. When the power source has been arranged early, results will not only be reflected in the economic benefits illustrated in the plan and the design, there will be far-reaching influence on construction and buildup and on production and operation.

The southwest region has very rich hydraulic energy resources. Among the 10 major hydroelectric power bases, Yunnan, Guizhou and Sichuan possess five of them (not including Nu Jiang in Yunnan). For more than 20 years, hydroelectric power workers have worked hard and have done a lot of preliminary work. To adapt to the urgent requirements for electricity in the national economy and for daily use, construction of the number of already approved large hydroelectric power projects situated on the various large rivers, such as Baozhusi Manwan, Pengshui, Ertan, and Dongfeng should be started within the near future without any hesitation based on the nation's ability to finance them. How do we develop the next step? It has been suggested that we select the best hydroelectric power stations and hydroelectric power bases and order them on the basis of plans for river systems. To do this work well, this writer believes, the following three principles in the guiding ideology must be considered:

A. The significance of continued development of cascade stations need not be repeated here.

B. In the southwest, where hydroelectricity constitutes a larger proportion, we must especially emphasize the problem of guaranteed output of hydroelectric power stations during the dry season. Otherwise, even though the installed capacity is large but the guaranteed output is low, we must install a large number of thermal power generators to balance the load during the dry season. Therefore, we must regulate the reservoir, set up spaces for generators beforehand to reduce the initial installed capacity, and reduce the ratio between installed capacity and guaranteed output (the ratio should best be set at 2 and should not surpass 2.5 at the most). We must actively develop users of seasonal electric power and study the problem of joining with the power network of the northwest region to realize compensatory regulation of hydroelectricity.

C. We must break through administrative boundaries, and consider the balance of electric power and investment in power transmission and transformer projects. We should select the best power source and hydroelectric power base based on the minimum current cost of construction of the system. It will be necessary to conduct economic comparison of many composite plans, comprehensively consider geological conditions, flooding by the reservoir, difficulty and ease of construction, link-up among groups and such factors to select the best and provide the information for the leadership to make decisions so that long-range plans for the next 20 years or more can be arranged, and we should continue to strengthen and perfect them in future practice.

According to the three principles described above, we may preliminarily evaluate the five hydroelectric power bases in the southwest region. If the controlling step of Goupitan high dam of the Wu Jiang base can be established, then the Wu Jiang base should continue to develop its cascade stations as early as possible because its geographical location and scale are appropriate, there is a regulatory reservoir on the upper course and construction is not too difficult. Conditions for bases on the middle and lower courses of the Lancang Jiang are not bad. It is worth recommending them as one of the bases for continuous development of cascade stations. Although their geographical placement is slightly westward, compared to the Yalong Jiang, the per kilowatt share of investment for the added power transmission lines is slightly more than 100 yuan, and obviously this is not a major factor. Its favorable conditions, such as more appropriate scale, good geological conditions, singular targets for development, and a high guaranteed output, are more outstanding.

Comparison of Economic Indices of the Middle and Lower Course of the Lancang Jiang and the Upper and Middle Courses of the Huang He and Hongshui He

Item unit	No. of cascades	Area of River Valley	Average Yearly Flow	Drop	Installed capacity	Gnt'd output	Annual output	Installed capacity Gnt'd output	Farmland Flooded	Population Relocated	Invest. per unit kilowatt	Invest. per unit kwh	Concrete per unit kw	Farmland Flooded per 10,000 kw	Pop. Relocated per 10,000 kw
Hydroelectric Power Base	sta.	10,000 sq. kms.	m^3/sec.	m	10,000 kw	10,000 kw	100 million kwh	multiple	10,000 mu	10,000	yuan/kw	yuan/kwh	m^3/kw	mu 10,000 kw	population 10,000 kw
Middle, Lower Courses of the Lancang Jiang (Gongguoqiao to mouth of the Nan'a He)	9	9.7-16	985-1985	835	1272	591	663	2.15	8.3	4.6				65	36
Upper, Middle Courses of the Huang He (Longyangxia to Qingtongxia)	16	13-28.5	640-1050	1084	1243	477	506	2.61	32.2	15.4	950	0.23	1.8	255	122
Hongshui He (Tianshengqiao to Datengxia)	10	5-19	612-4210	756	1112	547	601	2.03	16.0	17.8	1070	0.2	2.2	144	160

Note: (1) There are two figures in the columns for the area of the river valley and the average volume of flow over many years. They are respectively the figures for the first and the last cascades.

(2) The hydroelectric power base on the middle course of the Lancang Jiang mentioned above refers to the five cascade stations between Gongguoqiao and Sijiacun on the middle course. Planning work over the last few years shows that because of the construction of the high dam at Xiaowan, the downstream cascades have become clear. This writer's opinion is to establish a hydroelectric power base on the middle and lower courses of the Lancang Jiang (nine cascades).

These advantages may be summarized into two main ones: One is that the benefits from a large guaranteed output are high. The second is that the scale of construction and the difficulty in construction are smaller. Except for the Xiaowan project that is of a large scale, the remaining eight cascade projects mostly have a dam height of about 100 meters or less. The largest, Nuozhadu Dam will store water up to 136 meters high. The base of the dam is granite. Construction would not be very difficult but the benefits of this cascade are very great. The installed capacity will be 12.7 million kilowatts and the guaranteed output will reach 5.9 million kilowatts. The ratio of installed capacity to guaranteed output is 2.15 times, and basically there is no redundant capacity. It will truly substitute 1 kilowatt of thermoelectricity with 1 kilowatt of hydroelectricity. This is not easy to accomplish in the southwest region. Therefore, we suggest continuous cascade development for the hydroelectric power bases in the middle and lower courses of the Lancang Jiang. This will contribute importantly to the development of electric power in Yunnan and the southwest and it is expected to be an important energy base supplying electricity to the South China region following the Hongshui He.

9296
CSO: 4013/89

GROUNDWORK LAID FOR CONSTRUCTION OF BIG MANWAN PROJECT ON THE LANCANG JIANG

Kunming YUNNAN HUABAO in Chinese No 1, 1983 pp 4-5

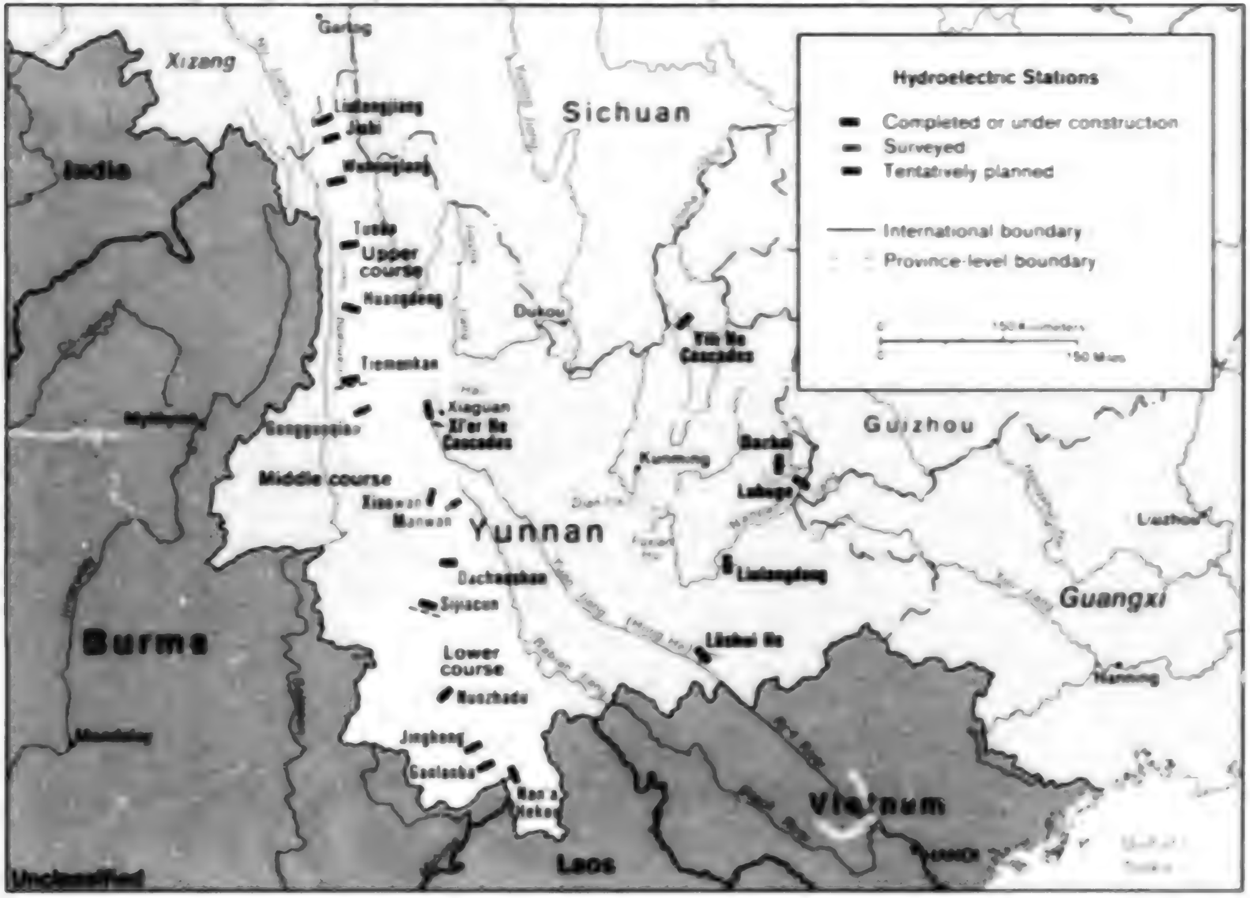
[Text] Yun County's Manwan is located on the middle course of the Lancang Jiang in Yunnan Province in a gorge between Yun County and Jingdong County. Here, there are rushing torrents and imposing, precipitous mountains, a spectacular stretch of the Lancang Jiang where the volume of water is abundant--the average yearly flow is 1,230 cubic meters per second--and the terrain favorable. The rock [formations] are intact, pressure resistance is high, the alluvial layer is thin, and a major road artery runs through the area--ideal conditions for the construction of a hydroelectric power station.

According to plans, a dam 125 meters high with a reservoir capacity of 1.1 billion cubic meters and an installed generating capacity of 1 million kilowatts (guaranteed output: 330,000 kilowatts) will be built on this site. Yearly electricity output will be 5.4 billion kilowatt-hours. With regulation provided by the Xiaowan Reservoir upstream, installed capacity will be 1.5 million kilowatts and output during the dry season will be 660,000 kilowatts (7.73 billion kilowatt-hours).

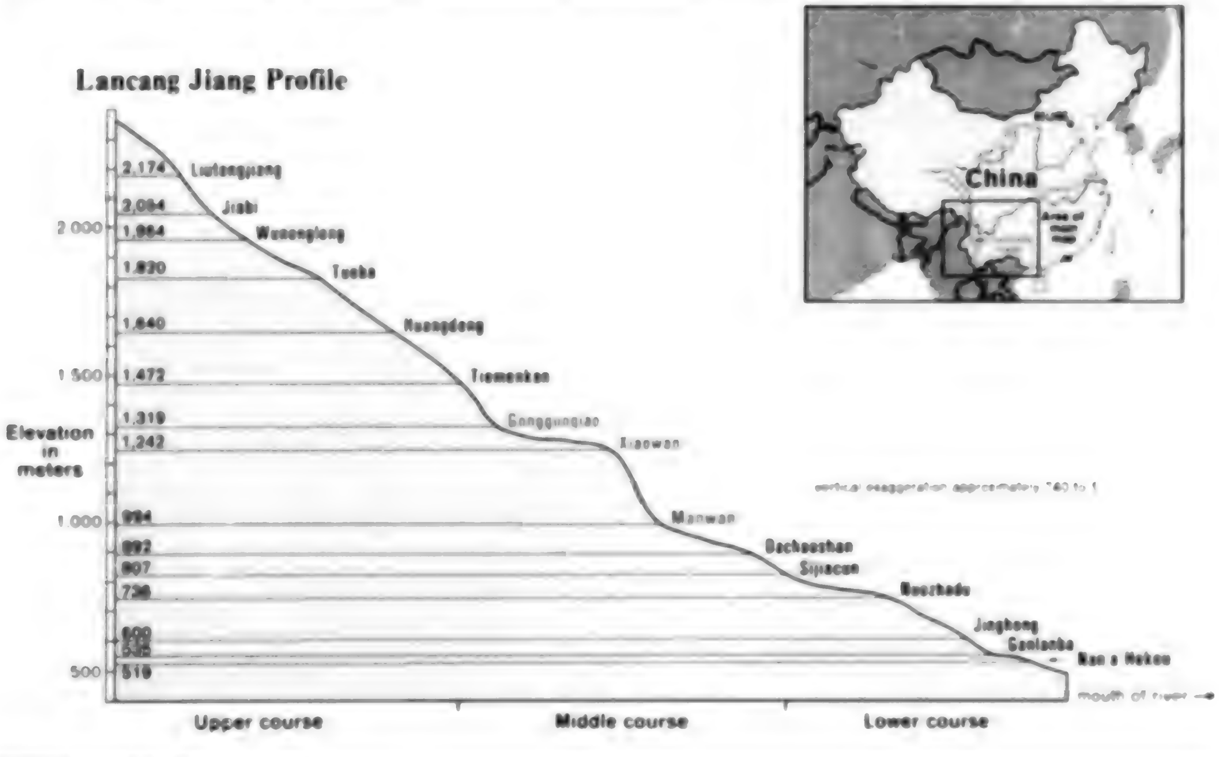
In October 1975, survey and design personnel of the Kunming Survey and Design Institute of the Ministry of Water Conservancy and Electric Power arrived on the site. These teams, in order to develop the hydraulic resources of Manwan, have worked hard for the past several years in the mountains and valleys to conduct extensive surveys and tests, determining the engineering geological conditions of the region and the engineering geology for the dam site itself.

Today, the survey and design personnel are redoubling their efforts and are deciding on the type of dam [to be constructed], calculating the engineering parameters to draw up preliminary plans in preparation to officially begin construction.

China: Lancang Jiang Development Project and Other Hydroelectric Stations in Yunnan



Lancang Jiang Profile



505687 (A01895) 4-83

Site of the Manwan dam.

The Jiajiu Hydrologic Station. This station has provided more than 30 years' worth of hydrologic data for the development and use of the Lancang Jiang.

Site of the Xiaowan dam.

CSO: 4013/178

HYDROPOWER

XI'ER HE CASCADE HYDROPOWER PROJECT MAKES STEADY PROGRESS

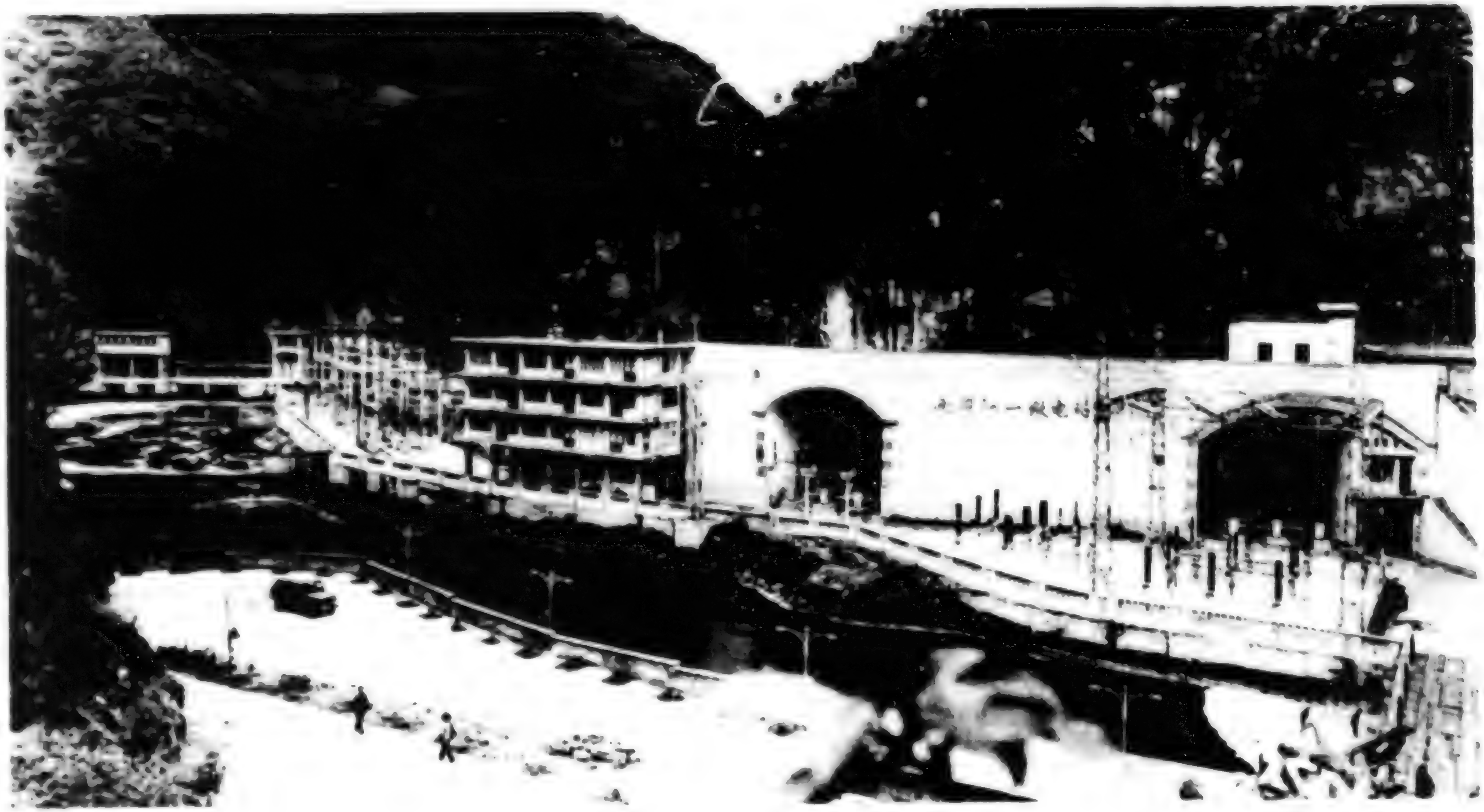
Kunming YUNNAN HUABAO in Chinese No 1, 1983 pp 2-3

[Article by Zhu Xiangwei [2612 4382 0251]

[Text] Just before the beginning of the new year [1983], we paid a visit to the Western Yunnan Electric Power Bureau. This bureau's entire complement of staff and workers was gearing up to put a new face on the bureau's work and wage an all-out struggle in the spirit of the 12th Party Congress.

We first visited the Xi'er He cascade power stations which are subordinate to the bureau. These stations, located at the foot of the Cang Shan, constitute one of Yunnan's backbone power station projects. The now completed first, second, and fourth cascade hydroelectric power stations have a total installed capacity of 225,000 kilowatts and after the third cascade power station, now under construction, has been completed, the installed capacity will be boosted to 255,000 kilowatts. The station's personnel informed us that the Party's 12th Congress had made new and higher demands on them. In order to carry out the spirit of the Congress, they would have to handle electric power production well and work hard to resolve the current tense energy situation so as to provide more support to the province to quadruple industrial and agricultural gross output value.

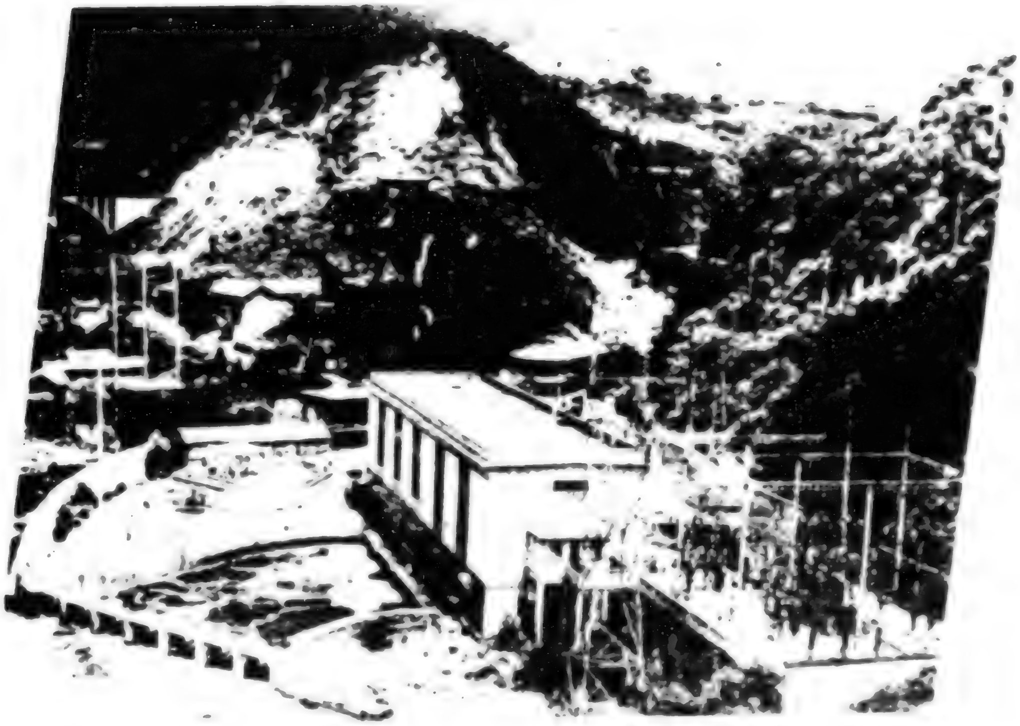
At the Xi'er He cascade power stations, we ran into members of the leading group of the Western Yunnan Electric Power Bureau, the same group that was completely reorganized in June of last year [1982]. Their average age is 49.5 years and more than two-fifths of them are at the university or polytechnic school level. Over the past half year and more this group has made new breakthroughs during the course of its work and scored outstanding successes. They have new plans for 1983. "Being one of the power departments playing a key part in China's economic construction strategy, we must play our part in the quadrupling of the province's gross industrial and agricultural output value and use the spirit of quadrupling to make heavier demands upon ourselves," they said. Looking back on the past 6 months and more, they said that this new group of theirs was going to assume a new posture and work hard to conform to requirements to be revolutionary, youthful, knowledgeable, and specialized.



Exterior view of the Xi'er He First Cascade Hydroelectric Power Station, Western Yunnan Electric Power Bureau.

Dam of the Xi'er He Second Cascade Power Station

Generators of the Second Cascade Power Station



Exterior View of the Xi'er He Fourth Cascade Power Station.

CSO: 4013/178

HYDROPOWER

LUBUGE PROJECT ENTERS FINAL CONSTRUCTION PREPARATION STAGE

Kunming YUNNAN RIBAO in Chinese 25 Mar 83 p 1

[Text] The Lubuge Hydroelectric Power Station project, Yunnan's largest in terms of installed capacity, has now entered the final stage of construction preparation.

The Lubuge Hydroelectric Power Station is located on the Huangni He, between Luoping County in Yunnan and Xingyi County in Guizhou Province. The Huangni He is a tributary of the Nanpan Jiang and has an annual average volume of flow of 164 cubic meters of water a second. The Lubuge Hydroelectric Power Station is the last of the Huangni He cascade power stations and requires the cutting of channels with a combined length of 24 kilometers. The power house is built in a cavern, and the underground portion of the project requires more work than all theother underground water conservancy and electric power related construction carried out over the past 30 years in Yunnan Province. An earth-and-rock-fill dam 100 meters high will be constructed in a gorge to create a regulatory reservoir with a capacity of 110 million [sic] cubic meters. Four generators (total installed capacity: 600,000 kilowatts)will be installed on the reservoir. These generators will be capable of producing 2.96 billion kilowatt-hours of electricity a year.

Surveying for this hydropower station began back in 1958 and the first construction crews arrived on the site in 1976. For the past 7 years, these crews have had to deal with tremendous problems. Blasting their way through the mountains, they have built more than 100 kilometers of roads and put in water and power hook-ups. They have excavated a 9-meter-diameter power tunnel and secondary tunnels with a total length of more than 800 meters. They have blasted out a base camp on the precipitous slopes and built offices, barracks for the workers, a hospital, company store, etc., totalling more than 190,000 square meters, laying the groundwork so that major construction can begin by the end of this year assisted by foreign capital. With a pioneer spirit, the construction workers are coping with harsh living conditions, shortages of material, and raw, rainy weather, sparing no effort to finish the preparatory work with the goal of commencing major construction work by the end of the year, blocking the flow of the river by 1986 and generating power by 1989.

CSO: 4013/188

PLANNERS DETERMINE GIANT ERTAN PROJECT TO BE TECHNICALLY FEASIBLE

Beijing RENMIN RIBAO in Chinese 19 Mar 83 p 1

[Article: "Big Hydropower Station Can Be Built at Ertan on the Yalong Jiang"]

[Text] Following an extended period of field surveys and analytical studies, several hundred Chinese specialists and scientific and technical personnel have initially determined that, from a technical standpoint, it is possible to build a large-scale hydroelectric power station at Ertan on the Yalong Jiang in Sichuan Province.

Ertan is located 40 kilometers north of Dukou City. The banks are precipitous and the flow here is a rushing current. Conditions are good for building a hydroelectric complex with a dam 245 meters high, a reservoir with a storage capacity of 5.8 billion cubic meters of water, and 3 million kilowatts in installed capacity capable of producing 16.5 billion kilowatt-hours of electricity a year. Upon completion, the station will have a powerful impact on the development of the economy of the southwest region. In 1972, the Chinese Academy of Sciences organized ten or so of its institutes, organs of the Ministry of Electric Power, seismology departments, and units of the People's Liberation Army to work closely together. Employing remote sensing technology combined with geological surveys in the field, they amassed a large amount of data from which to form some conclusive opinions.

From 13-17 March of this year, the State Planning Commission and the Chinese Academy of Sciences invited a number of noted specialists to comment on their summing-up report.

CSO: 4013/171

HYDROPOWER

STATUS REPORT ON TONGJIEZI HYDROELECTRIC PROJECT

Beijing SHUILI FADIAN /WATER POWER/ in Chinese, No 12, 12 Dec 82, p 49

/Article by Zhang Jihua /1728 4949 5478/ in the column: "Hydroelectric Power Stations Under Construction"/

/Text/ The Tongjiezi Hydroelectric Power Station

The Tongjiezi Hydroelectric Power Station is located in Leshan City, Sichuan Province. It is a cascade station at the end of the middle reaches of the Dadu He, 33 kilometers downstream from the now completed Gongzui Hydroelectric Power Station. The Chengdu-Kunming Railroad passes by 17 kilometers downstream and extends 80 kilometers along the highway to Leshan City. The geographic position is appropriate and transportation is convenient. The river valley area above the dam site is 76,400 square kilometers, constituting 98.7 percent of the total area of the river valley. The Dadu He has an abundant water flow, and runoff is even and stable. Annual runoff reaches 47.3 billion cubic meters.

The power station is a main project that will provide comprehensive benefits mainly for generating electricity but also for the passage of timber, irrigation, and the improvement of navigation. The main project uses a concrete gravity dam with a maximum dam height of 76 meters. The power plant is a riverbed plant with total installed capacity of 600,000 kilowatts (four 150,000-kilowatt generators). The guaranteed output is 130,000 kilowatts and the annual average electricity output is 3.21 billion kilowatt-hours. It is the largest hydroelectric power project being built in Sichuan Province at present. After completion of the power station, the total reservoir capacity will be 200 million cubic meters. It can realize reverse regulation of the Gongzui Hydroelectric Power Station upstream, and improve navigation in the downstream river segment by daily regulation of the water flow by the Gongzui Power Station so that the power station can fully develop its role of regulating peak and frequency modulation in the system. It can improve output by more than one-fold.

The exposed geostrata in the reservoir area is mainly basalt, limestone and sandstone. The slope of the bank is stable, and there are no problems with collapsing banks and submergence. The geological conditions in the area of the dam site are complex. There are deep troughs on both the left and right banks of the riverbed. On the two sides of the deep right trough are four medium to gentle inclined faults along the river. The base rock is fragmented, and soft, weak intercalations are commonly present in the dam base. The conditions are rather complex. After a longer period of surveying, designing and experimental research, the problems have now been cleared up and the major technical plan has been determined.

In the arrangement of the main project, an open diversion canal (to be changed to a section of the water blocking dam after completion) and the powerhouse have been built on the left side of the riverbed to facilitate operation of the power station, avoid interference with the power station by the log chute and for the stability and protection of the side slope of fragmental rock and soil on the left bank. A spillway dam is planned in the deep right trough.

The riverbed powerhouse dam section: This is located on the beach of the left bank of the riverbed. The total length is 130 meters (separated into four dam segments). The installation room is 50 meters long. To satisfy the requirements for stability in slippage resistance of the body of the dam, the powerhouse and the body of the dam are joined together as a unit on the riverbed. The width of the top of the dam is 29 meters, and the total width of the body of the dam is 111.0 meters. The main and auxiliary powerhouses and the tailwater floodgate section have a total width of 58.25 meters.

Bottom hole dam segment: A 15-meter scouring bottom hole dam segment has been built on each side of the dam section of the powerhouse. The two bottom hole dam segments form a scouring funnel in front of the dam section of the powerhouse and serve to discharge flood water. The bottom holes measure 5x6 meters. When floodwaters reach the design level, the discharge of each hole is about 600 cubic meters/second.

Spillway dam section: This is situated in the deep right trough of the riverbed. The front edge of the overflow is 100 meters long. A five-hole overflow tunnel has been selected. The width of the dam segment for each tunnel is 20 meters. Each hole of the spillway dam section is 14 meters wide and 17.5 meters high. Arc floodgates operated by fixed gate controls are used. When designing the discharge and verifying the floodwaters, the single width flow is 100.3 and 127 square meters/second respectively.

Raft lock: Timber passing through the dam is queued. The raft lock is built on the slope of the right bank. The front edge of the lock is 33 meters wide. The lock chamber is 14 meters wide. The first, second and third lock chambers are 70 meters long. The fourth lock chamber is 81 meters long. A fixed raft diversion channel 70 meters long is built upstream and the total length is 685 meters.

Left and right bank connecting dams: These are joined by a soft connection. The dam on the left bank is an asphalt concrete oblique wall rock-fill dam, and the one on the right bank is also a core wall rock-fill dam.

Total amount of construction of the main project: The work involves excavating 2.095 million cubic meters of the covering layer, 2,141,100 cubic meters of rock, 34,200 cubic meter of rock in tunneling, piling 819,100 cubic meters of rock, pouring 2.711 million cubic meters of concrete, backfilling 1,639,500 cubic meters of sand and gravel, and setting up 696 tons of steel structures.

The Tongjiezi Hydroelectric Power Station was designed by the Chengdu Surveying and Design Institute, and the Seventh Engineering Bureau is in charge of construction. The construction team arrived at the site in 1979 and preparatory work for construction is being actively carried out.

9296
CSO: 4013/89

GUANGXI, GUANGDONG HYDROPOWER CONSTRUCTION

Beijing SHUILI FADIAN [WATER POWER] in Chinese No 2, 12 Feb 83 centerfold

[Photographs and captions]

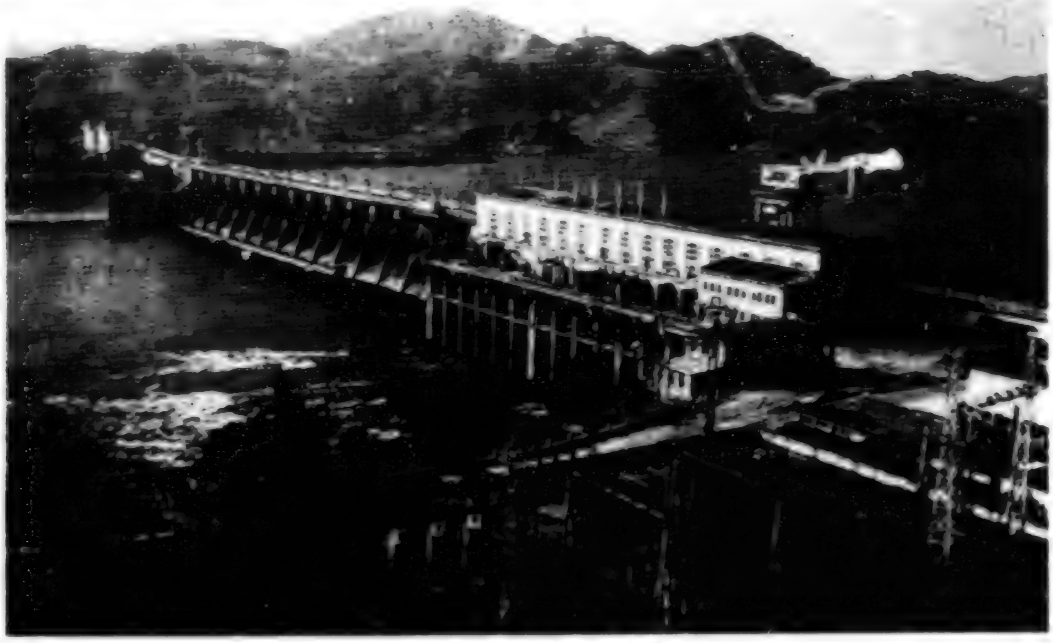


Figure 1. View of the Xijin hydropower station [southern Guangxi].

Figure 2. Boat lock of the Xijin hydropower station [seen in far upper left of Figure 1].

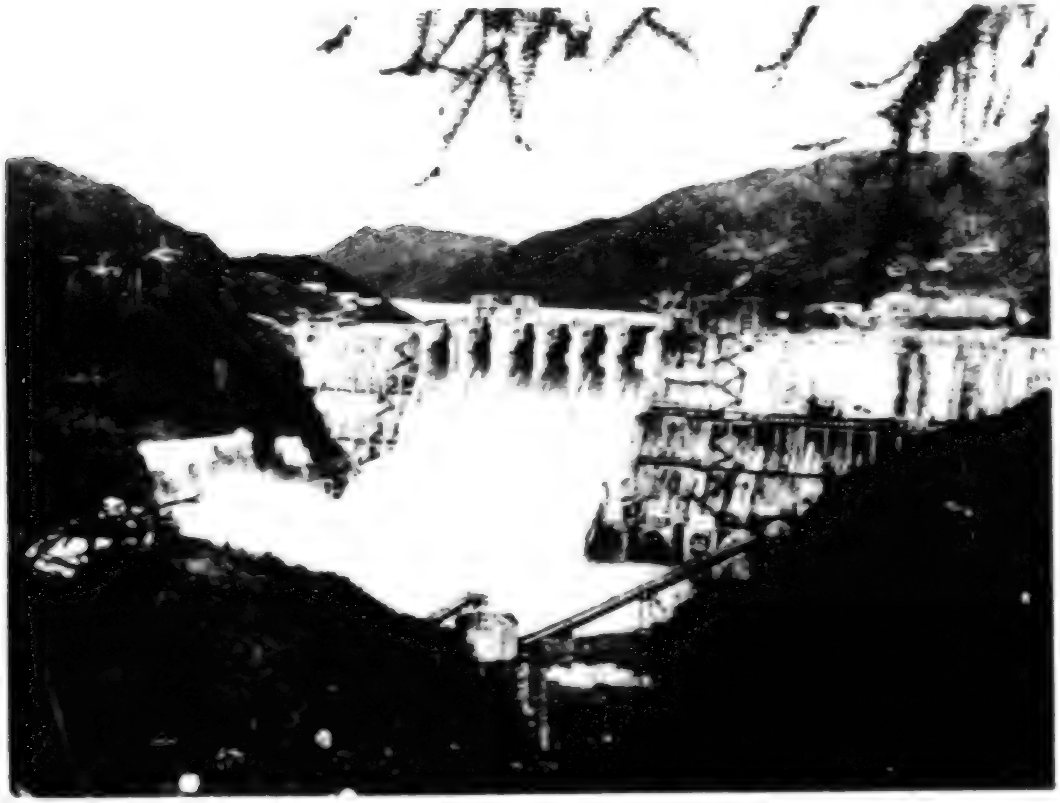


Figure 3. View of the Fengshuba hydroelectric power station [northeastern Guangdong].

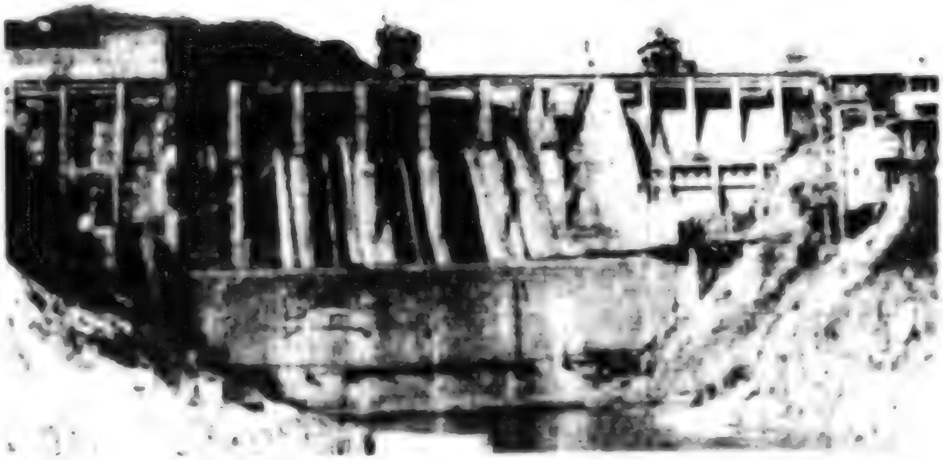


Figure 4. The Niululing hydroelectric power station [Hainan Island].

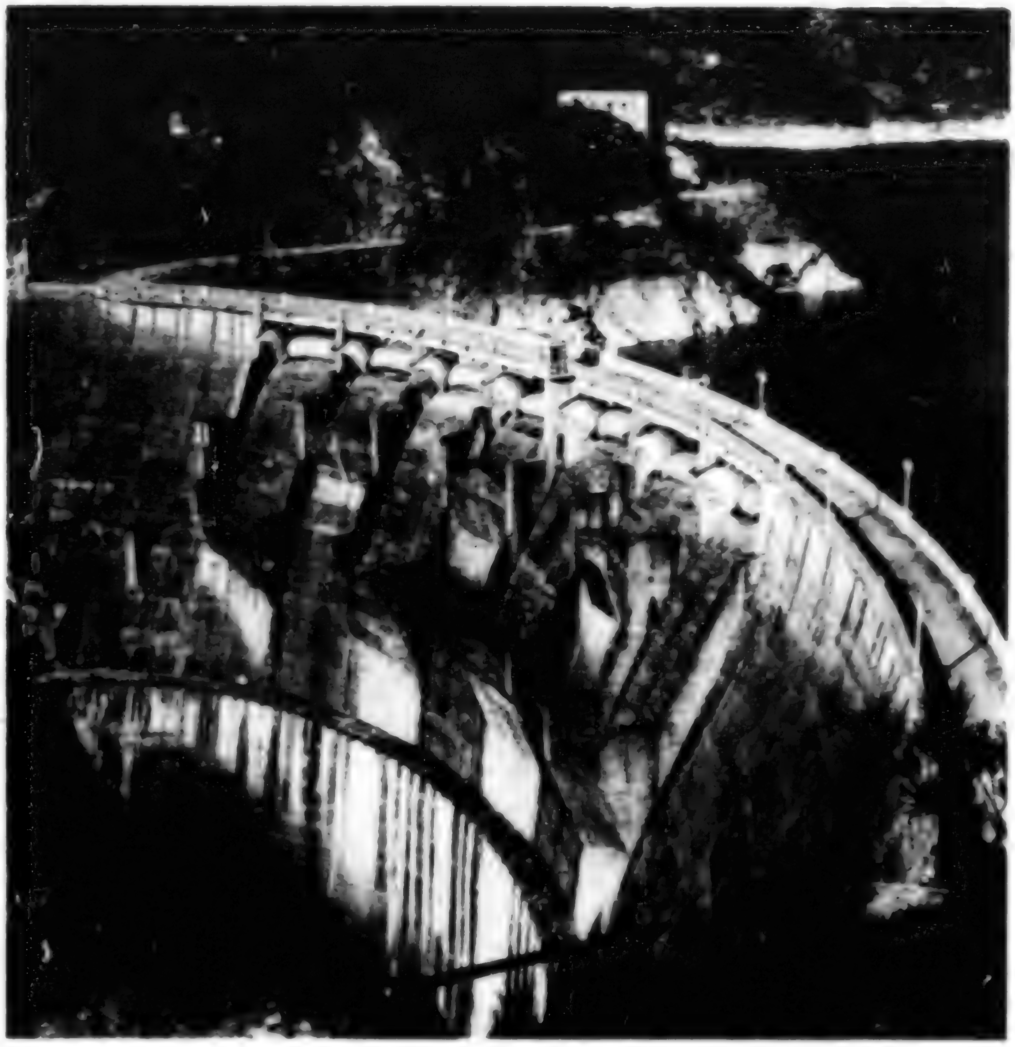


Figure 5. Overflow arch dam of the Liuxi He hydroelectric power station [Guangdong]

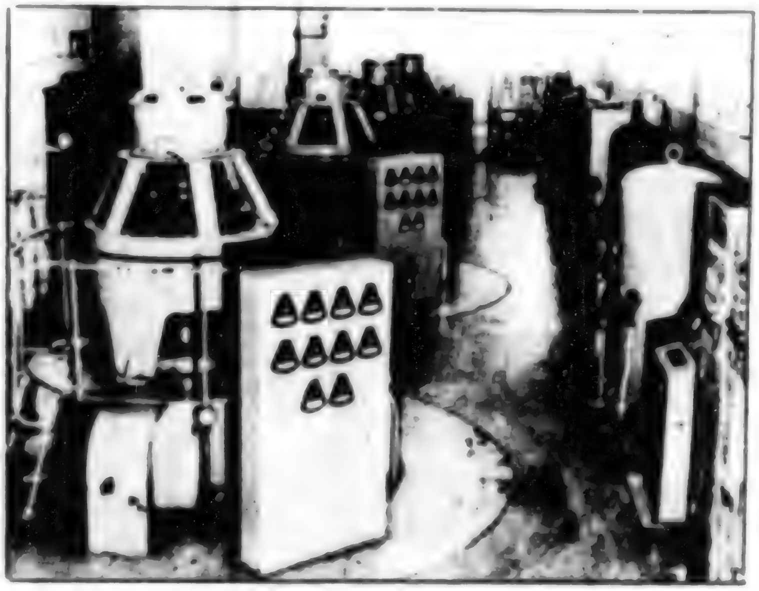


Figure 6. Interior of the power house of the Liuxi He hydroelectric power station.

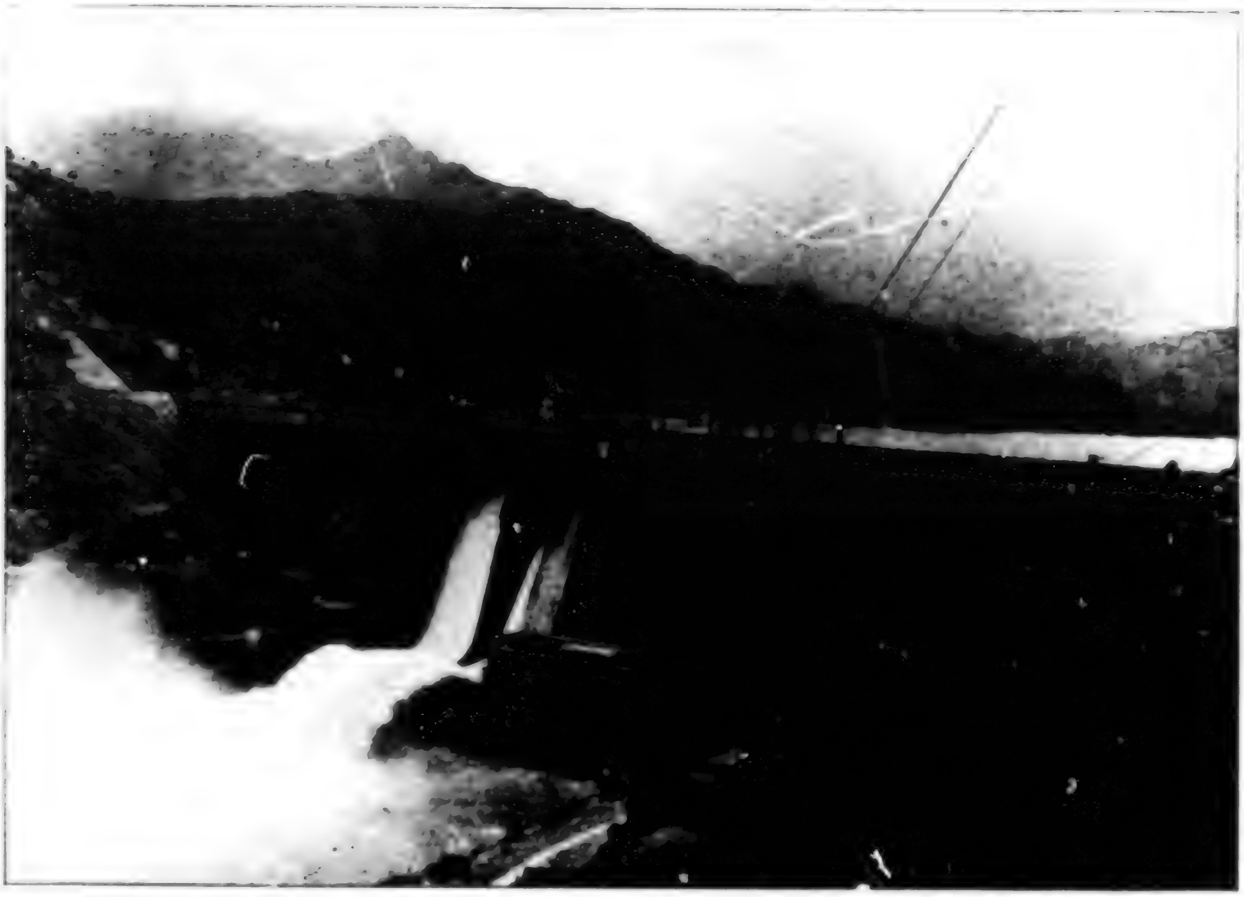


Figure 7. View of the Xinfeng Jiang hydroelectric power station [Guangdong].

Figure 8. Interior of the power house of the Xinfeng Jiang Hydroelectric power station.

CSO: 4013/159

HYDROPOWER

ECONOMIC CONSIDERATIONS SPUR RENEWED EFFORTS TO EXPLOIT SICHUAN'S HYDRAULIC RESOURCES

Chengdu SICHUAN RIBAO in Chinese 15 Jan 83 p 1

[Article by Shui Xuan [3055 1357]: "Taking Steps and Exerting Great Effort To Realize Chinese-Style Rural Electrification; Sichuan Tentatively Decides To Designate Ten Counties as Test Points, Including Dayi and Guan Counties"]

[Text] To develop Sichuan's superiority of abundant hydraulic resources, the higher provincial authorities recently issued a new regulation concerning the province's efforts to develop small-scale hydroelectric power according to the spirit of the directive of the leading comrades of the Central Committee to develop small-scale hydroelectricity in Sichuan and with the support of concerned departments of the Central Committee so that we can accelerate the buildup of small-scale hydroelectric power based on an overall plan and rational distribution. Provincial water conservancy and electric power departments have also tentatively designated ten counties, including Dayi and Guan counties, which have abundant resources for hydroelectric power and which have a substantial foundation for developing small-scale hydroelectricity as test points for our province to realize Chinese-style rural electrification.

Sichuan's abundant hydraulic resources are found in many spots over a broad area. According to a general survey conducted in 1979 by the provincial water conservancy department, the reserves of hydraulic power throughout the province come to 150 million kilowatts, with an exploitable capacity of 92,000,000 kilowatts. Practically every county can build small-scale hydroelectric power projects. The exploitable capacity in 60 percent of the counties can exceed 10,000 kilowatts. Up to the end of 1981, 8,658 small rural hydroelectric power stations had been completed throughout the province, and 9,979 generators had been installed with a capacity of over 930,000 kilowatts. There are some 20 counties with an installed capacity surpassing 10,000 kilowatts. But the development at the localities is not balanced. Many localities have an abundance of hydraulic resources but not many small-scale hydroelectric power projects have been built. Although 89 percent of the communes throughout the province now have electricity, half of the brigades and three-fourths of the production teams still do not have electricity. Regions in which small-scale hydroelectric power has developed relatively quickly still have not fully developed their benefits because accessory construction could not catch up in time, conflicts in linking large and small power networks were not solved well, or because of limitations of administrative districts and ownership systems, and because management was not strengthened. These situations show that local power buildup still has a long way to go to meet the demands of rural economic development and a better standard of living for the people.

During the previous period, when leading comrades of the Central Committee came to Sichuan on inspections, it was pointed out that small-scale hydropower is an important source of energy. Sichuan should develop its abundance of hydraulic resources and accelerate the development of small-scale hydroelectric power. During the past few months, concerned departments of the province have conducted many studies under the direction of the provincial committee and the provincial government to implement the spirit of the directives of the leading comrades of the Central Committee and obtained the support of concerned departments of the Central Committee. They have proposed several new measures to develop Sichuan's small-scale hydroelectric power. They stipulated that in order to accelerate the buildup of hydroelectric power in Sichuan, the principle of simultaneous development of the large, the medium and the small and of combining state and local efforts to develop electric power must be insisted upon. All localities with hydraulic resources should build small-scale hydroelectric power stations (networks) under uniformed planning and arrangement. The construction of small-scale hydroelectric power stations (networks) must firmly adhere to the spirit of self-reliance, and the state must also provide subsidies and support. To mobilize the enthusiasm of each level to develop electric power, small-scale hydroelectric power projects must implement the principle of mainly "building the projects themselves, managing such projects themselves, using the power themselves" and the policy of "using electric power to nurture electric power." Small-scale hydroelectric power projects should mainly generate and use electric power by themselves and seek a balance within the local region, and the projects should mainly be oriented towards villages and county seats. The measures also included some concrete stipulations concerning the correct handling of the problem of joint operation between small-scale hydroelectric power stations (networks) and large power grids according to relevant policies of the Central Committee based on the principle of taking into consideration the benefits of the central authority, the locality, the collective, and the individual. The ownership, the subordinate relationship and the financial relationship of small-scale hydroelectric power stations (networks) that join with large grids will not change. To fully develop the benefits of small-scale hydroelectric power stations, the new regulations have changed the past limitations placed upon small-scale hydroelectric power stations in power generation, supply, and consumption. Price and fee calculations for electricity supplied by large and small power networks to each other were also adjusted. They also stipulated that the profits of enterprises subordinate to the county and below the county level from the resale of electricity and the profits of small-scale hydroelectric power stations realized in generating and supplying electricity will not be included in the financial budget. The policy of "using electricity to nurture electricity" will be implemented and all revenues will be used for local electric power.

Several regulations of the higher provincial authorities concerning the active development of small-scale hydroelectric power pointed out: Some areas with a surplus supply of small-scale hydroelectric power have been using electricity experimentally as a firewood substitute in curing tobacco, cultivating seedings, incubation, cooking, boiling water, etc. The good results from these experiences should be summarized and popularized progressively.

Wenjiang, Nanchong, Leshan, Dayi, and Guan counties are now actively drawing up plans to accelerate the buildup of small-scale hydroelectric power stations according to the relevant regulations of the higher provincial authorities. They are also preparing to select and organize a number of superior new construction projects that do not require a lot of investment, that can realize great benefits, and that can produce results quickly, and they are preparing to develop a number of small hydroelectric power stations jointly with communes and brigades. At the same time, they are emphasizing the work of completing accessories of power stations already built, developing their potential, making improvements and renovations, and strengthening management so that they can develop their benefits to the fullest. The provincial water conservancy and electric power department has studied the work in rural electrification at the test points of the ten counties and it has dispatched technicians to help carry out planning in Dayi County first.

9296
CSO: 4013/122

HYDROPOWER

ACCELERATING SICHUAN'S BUILDUP OF SMALL-SCALE HYDROELECTRIC POWER

Chengdu SICHUAN RIBAO in Chinese 15 Jan 83 p 1

[Commentary]

[Text] Small-scale hydroelectric power is an important energy source. It serves greatly in solving the problems in the use of electricity in villages and county seats and in agriculture and local industry. The building of small-scale hydroelectric power is directly related to agriculture and energy, which are the two key strategic points in economic development. Sichuan's hydraulic resources are abundant and widely distributed. The enthusiasm of each locality, commune and brigade and the masses for developing small-scale hydroelectric power is very high. For many years, especially in recent years, the achievement in developing small-scale hydroelectric power has been great. But the proportion of small-scale hydroelectric power currently available as a percentage of the exploitable and usable hydraulic resources is still very small. Now the higher provincial authorities have proposed some new measures. They have provided favorable conditions for the development of small-scale hydroelectric power. Each locality must strengthen leadership, accelerate progress in the buildup of small-scale hydroelectric power and contribute towards the realization of the strategic goals proposed by the 12th Party Congress.

The buildup of production relies on policy and science. In accelerating the buildup of small-scale hydroelectric power, we must first use policy to mobilize the enthusiasm of each sector. Practice proves that as long as we insist on implementing the principle of mainly building, managing and using small-scale hydroelectric power by ourselves and on the policy of using electric power to nurture electric power so that the units involved in developing electric power and the masses can realize benefits from developing small-scale hydroelectric power, then we can encourage all sectors to develop the spirit of self-reliance, solicit private funds and invest labor to develop small-scale hydroelectric power. Of course, the state must also provide loans and investment subsidies to support the effort and to appropriately increase subsidies when financial conditions allow. Electric power departments managing large power networks should realize that small-scale hydroelectric power is an important supplement to the overall development of electric power. They should start out from the overall situation and actively support small-scale hydroelectric power. The departments of water conservancy and hydroelectric power must help localities with hydraulic resources to carry out uniformed planning and rational arrangement so that small-scale hydroelectric power can become balanced within the locality as much as possible, serve agriculture, local industry and people's lives, and promote the development of rural electrification.

In recent years, as agricultural and industrial production has prospered, local revenues and income of communes and brigades and commune members have continued to increase, small-scale hydroelectric power facilities and production have also increased. The material and financial strength of each locality to develop small-scale hydroelectric power is more abundant. At present, good beginnings have emerged in some localities where the masses have gathered funds to develop small-scale hydroelectric power. This reflects the prosperous scene in the building of small-scale hydroelectric power. Each locality should act according to circumstances, organize leadership well, and, in particular, water conservancy and hydroelectric power departments must provide technical assistance and guidance. At the same time, existing small-scale hydroelectric power stations must help complete accessories, strengthen management, and fully develop their benefits.

9296
CSO: 4013/122

HYDROPOWER

ARMY OF CONSTRUCTION WORKERS CONVERGES ON THE HONGSHUI HE

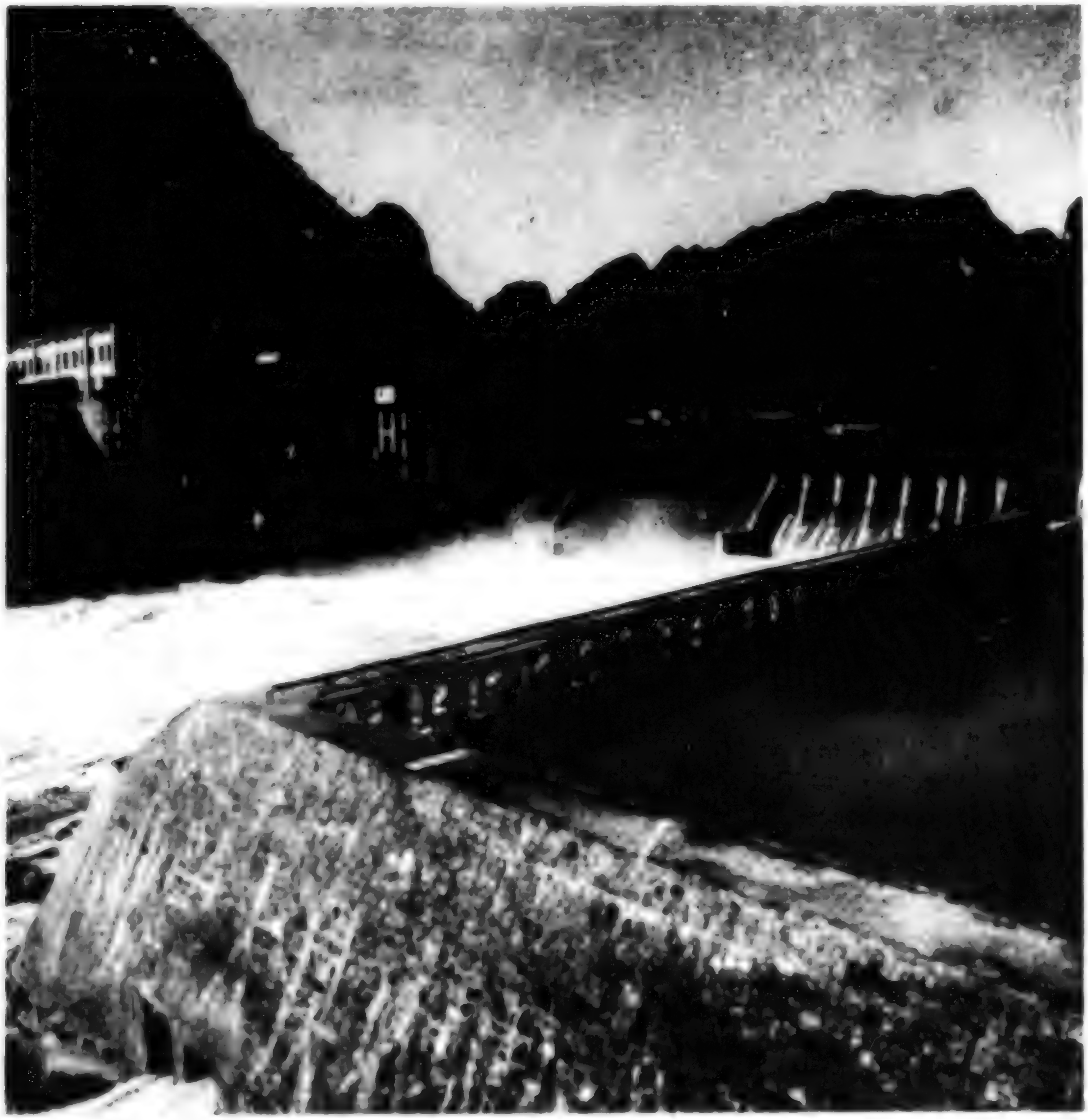
Beijing XIANDAIHUA [MODERNIZATION] in Chinese No 3, 25 Mar 83 p 30; front cover

[Article by Wang Dehua [3769 1795 5478] of the Ministry of Water Conservancy and Electric Power: "Why Has an Army of Hydropower Construction Workers Descended on the Hongshui He?"]

[Text] The Hongshui He, located in the central part of Guangxi Province, is the mainstream of the Xi Jiang system of the Zhu Jiang [Pearl River] River Valley. Its volume of water is large and its drop sharp and concentrated. In its 1,050-kilometer-long mainstream segment, the total drop is 750 meters and its annual average volume of flow is 133 billion cubic meters, almost three times that of the Huang He! The upper course of the Huang He is generally acknowledged as being China's premier hydropower base in terms of abundant hydraulic resources and excellent conditions for development. But in a comparison of the Hongshui He and the Huang He, the former is by no means inferior. Experts contend that the "Red and the Yellow" are China's best bases of hydraulic resources. According to the plans of the departments concerned, 10 cascade power stations will be built on the Hongshui He, namely Tianshengqiao Bapan [high dam], Tianshengqiao Basuo [low dam], Pingban, Longtan, Yantan, Dahua, Bailongtan, Etan, Qiaogong, and Datengxia. The total installed capacity will be 11 million kilowatts and the average annual power output 60.3 billion kilowatt-hours. The largest hydroelectric power station in China today, the Gezhouba Hydropower Station, has a total installed capactiy of 2.71 million kilowatts but the "dragon's head" of the Hongshui He cascade stations, Longtan, will have an installed capacity of 4 million kilowatts, much, much bigger than Gezhouba. Fully developed and utilized, the hydraulic resources of the Hongshui He would equal an enormous coal mine with an annual production capacity of 40 million tons.

Today, an army of 20,000 construction workers has converged on the Hongshui He; the time for the river to benefit the people has arrived. In May 1981, the 60,000-kilowatt generator of the first stage of Etan--the first of the Hongshui He cascade power stations--began to generate power. After the second stage of construction is finished the total installed capacity will be increased to 560,000 kilowatts. The No 1 generator of the 400,000-kilowatt Dahua Hydropower Station could be generating electricity in the latter part of 1983 and in 1982 work was resumed on the 1,320,000-kilowatt Tianshengqiao low dam, a project that had been postponed due to the economic readjustment. This year, work began on the 110,000-kilowatt Yantan Hydropower Station and surveys are being made and plans drawn up for three other backbone power stations.

The development and utilization of the Hongshui He is critical to the growth of industry and agriculture in South China. Since the trial implementation of the Guangdong Special Economic Zone, accelerated economic growth has put a severe strain on energy resources. Today, in addition to the large amount of coal and fuel oil brought in from outside the province, power is also purchased from Hong Kong. Both Guangxi and Guizhou have abundant deposits of nonferrous metals but up to now there has been insufficient electric power to mine them on a large scale. Developed, the hydraulic resources of the Hongshui He could reverse this passive situation and solve the power use problem for the provinces in South China.



An exterior view of the Etan Hydropower Station on the Hongshui He.

CSO: 4013/190

BRIEFS

SICHUAN SMALL-SCALE HYDROPOWER--According to recent figures from relevant organs, Sichuan added another 305 small-scale hydropower stations in 1982, along with 445 newly added generators representing an installed capacity of 89,734 kilowatts. This surpassed the plan by 64.34 percent. Up to now, the province has a grand total of 8,963 small-scale rural power stations with 10,424 generators and a total installed capacity of 1,002,700 kilowatts. [Excerpt] [Chengdu SICHUAN RIBAO in Chinese 9 Feb 83 p 2]

NANYA HE PROGRESS REPORT--The No 2 generator at the Nanya He Third Cascade Hydropower Station has now officially joined the grid. On 5 March, the No 2 generator [installed capacity: 40,000 kilowatts] of the power station successfully conducted trials and formally joined the grid on the following day. [Text] [Chengdu SICHUAN RIBAO in Chinese 9 Mar 83 p 1]

TAIPINGWAN EARTHWORK COMPLETED--Dandong, 21 Feb 83. As of 20 February, the main project to excavate 350,000 cubic meters of earth and 270,000 cubic meters of rock for the joint China-Korea Taipingwan hydroelectric power station project had been completed. Rock excavation for the eight dam segments has also been finished. Construction on this hydroelectric station, located in Kuandian County, was started on 27 October 1982. More than 2,000 personnel from the 6th Hydropower Bureau are steadfastly maintaining construction quality so that the pouring of concrete can commence on 15 March, and a safe, fast damming of the river can be achieved. /Text/ /Shengyang LIAONING RIBAO in Chinese 22 Feb 83 p 1/

CSO: 4013/166

PROBLEMS IN DESIGN OF THERMAL POWER PLANTS EXAMINED

Beijing DIANLI JISHU [ELECTRIC POWER] in Chinese No 10, 5 Oct 82 pp 1-6

[Article by Wang Jiansan [3769 7003 005], Zhang Renjie [1728 0088 2638], Yang Hengzhuan [2799 1854 1104] of the Power Production Department, Ministry of Water Conservancy and Electric Power: "Views on Some Specific Problems in Designing Thermal Power Plants"]

[Text] Whether a power plant can operate normally after its completion is determined by many factors, chief of which are: Are the plant site and the planned arrangement appropriate, is the design rational, is the equipment selected good and reliable, is the construction quality guaranteed, and is operational management after the plant begins production good? These conditions are all indispensable. Whether the design is rational is a very important link. Since the founding of the nation, our power industry has developed from a very backward foundation to today's scale. The design personnel and comrades at other posts have all contributed greatly. Now, we can rely on our own strength to independently design large power plants of over 1 million kilowatts, and high voltage power transmission lines and power networks of 500 kilovolts and the technical standards are continuing to improve. Safety, the level of economical operation and the percentage of usability of equipment used in production have continued to improve. At present, under the guidance of the principle of antional economic readjustment, the design departments are conscientiously summarizing past experience and are absorbing foreign advanced technology to further improve the design standards of our power industry to better develop economic benefits from the operation of the projects. Based on the experience in production practices, we would like to express some opinions and hopes concerning several specific problems in design for related units and comrades to consider. At the same time, they can also serve as a reference for production units to carry out technical improvement and perfect power plants that have already begun production. Because of insufficient survey and research, we have proposed suggestions for improvement of some of these problems. In other cases, we can only point out the problems and ask related units to study and improve the situation.

I. Problems Concerning Coal, Water and Ash

(I) Coal

1. The coal yard of a power plant must have sufficient capacity to store coal. In present design regulations, stipulations concerning the coal storage capacity of power plant coal yards are still suitable for power plants with a normal supply of coal. But the stipulated coal storage capacity is not enough for some power plants, mainly because of the following two reasons: One is that some power plants use amounts of coal that vary greatly, there are many supply points and transportation distance is long. For example, local coal originally selected for use by some major power plants in the northeast can no longer be supplied. Coal now has to be shipped from many localities inside Shanhaiguan. The longest hauling distance is 2,000 kilometers. The varieties of coal are mixed. Because of insufficient storage capacity, shipments sometimes are not continuous, making it difficult to guarantee an even supply of coal and the blending of different types of coal, thus affecting normal generation of electricity. The second is that in some power networks with a relatively large percentage of hydroelectric power stations, the output of electricity drops during the dry season and more thermal power must be generated. However, coal production and railway transport requires maintaining a balance throughout the year. Therefore, more coal has to be stored at the thermal power plants during the season of abundant water for use during the dry season. In particular, at present, the supply of coal is tight. This is a more important point. Otherwise, during peak winter loads, the output of electricity will be insufficient and the use of electricity will have to be limited. Because of the two reasons above, and in order to turn the passive situation in production over many years around, some power plants such as the Liaoning Power Plant in the northeast and the Heshan Power Plant in Guangxi have been forced to enlarge their coal yards. This problem must be given more consideration in the future design of power plants.

2. The coal transport system must have reliable measures to eliminate the "three lumps" (large lumps of coal, lumps of wood, lumps of iron). Most of the coal crushers, ferromagnetic separators, and vibratory sieves installed in many of our power plants in the past cannot operate normally because of quality problems. Wood scrap separators were not installed at all. Large pieces of coal, iron, wire, and wood enter the coal transport system, reduce the output of the coal grinder, clog the coal and dust separators, and immobilize coaling machinery. Conveyor belts are scratched, and even fan coal grinders and medium speed coal grinders are seriously damaged. It is hoped that in the future, we may cooperate with concerned manufacturing plants to develop and include the use of superior quality coal crushers, ferromagnetic separators, vibratory sieves, wood scrap separators and such equipment to eliminate the "three lumps." Production units must also strengthen maintenance and management of such equipment to guarantee normal operation of the coal transport system.

3. The coal transport system must be equipped to eliminate dust. At present, the problem of flyash from the coal transport system of many thermal power plants is serious. The concentration of dust in the air at some sites reaches 150 to 200 milligrams/cubic meter, greatly surpassing the allowable level of

10 milligrams/cubic meter stipulated for environmental protection. Near coal crushers, the situation is even worse.

In recent years, some power plants have carried out measures of improvement with the help of design institutes and concerned units. For example, the power plants at Douhe, Jiangyou, Fuxian, and Chengdu have installed dust collectors at points where there is a lot of flyash and have realized preliminary results. The Douhe Power Plant uses a ring coal crusher which produces little noise and flyash. It is worth recommending. The Huaibei and Liaoning power plants separately improved the reverse stroke and hammer coal crushers and realized some results. Some power plants have installed sprinklers at appropriate places in the coal transport system to maintain a 4 to 5 percent moisture content in the coal supplied. This reduced the amount of flyash. Some power plants have included in their design mechanical vacuuming equipment. But in the past, because of the difficulty in digging coal mud when eliminating settled flyash, such equipment was not put to use regularly. Some power plants have now acquired better experience in improvement (such as the Douhe Power Plant). The above needs to be summarized and improved by the designing units and the power plants together. They should study ways to improve and to use the experience in designing new plants. Generally speaking, in selecting the types of coal crushers we should popularize the ring coal crusher and after a finalized model has been evaluated in the nation because it is superior to the reverse stroke and hammer crushers in eliminating flyash, noise, consumption of electricity and reliability.

4. Dynamic track scales should be used to measure incoming coal. At present, except for individual power plants which use track scales, most power plants use "inspection rulers" to sample and inspect incoming coal. The accuracy is poor. As the size of power plants grows and the amount of coal used by them increases, the use of "inspection rulers" will make it even more difficult to satisfy the requirements. To strengthen economic accounting, examine economic gains, and strictly carry out coal supply contracts, we must improve the measurement of incoming coal. After many years of efforts, we have successfully developed the dynamic electronic track scale. It has been tested by users and has passed national evaluation. This track scale can automatically record the load of each freight car and the total weight of the train as the train passes over the tracks. In the future, this should be used in newly built power plants and by large power plants that have already begun production. In using it, we should help the manufacturers make further improvements.

5. The problem of unloading frozen coal in cold regions. Some present measures do not produce big results. We need to study effective measures to solve this problem.

(II) Water

1. The area of the cooling tower should be appropriately increased. Our ministry's regulation on the designed annual percentage of guaranteed effectiveness of cooling towers is 90 percent. The temperature of recycled cooling water during the hottest period in summer rises to over 33°C for short periods.

At this time, the vacuum in the generator drops, and the output and efficiency are somewhat lowered. The probability that such a situation would occur is not more than 10 percent. Many other nations have generally established similar standards.

Considering the actual situation in our nation, the growth in the power industry in the near-term will not be too fast. The number of hours of equipment utilization will be high. This requires the generators to be fully loaded as much as possible to conserve the use of coal. Therefore, we may consider increasing the design percentage of guaranteed effectiveness of the cooling towers of large generators to 95 percent by suitably increasing the cooling area so that during the higher temperature season in summer, the output and efficiency of the generators can be basically guaranteed.

In addition, the actual temperature of recycled water in cooling towers with cement grid plates in summer sometimes surpasses the design value by 1-1.5°C. These water towers have less precise showering equipment and frequently water gushes from it. The equipment shifts position, dirt accumulates, and damage results. Repairs of large cooling towers require a longer shutdown time, therefore, daily operation is not in the "best state." In this aspect, it is necessary to provide appropriate leeway in the design.

2. We must prevent the flooding of the feed room and the recycled water room. When the water level in the feed room and the recycled water pump room is lower than the water level in the reservoir, we must consider preventive measures to avoid flooding when accidents due to operational error, malfunctioning of floodgates or bursting water pipes occur. In the past, major accidents involving pump room flooding have occurred in the large power plants at Douhe and Qinghe with great loss. Although the direct reasons were operational errors or qualty problems in welding, in analyzing these accidents we believe the following problems are worth studying when designing power plants:

1) In designing the feed water and recycled water pump rooms, we must pay attention to making the pipes, valves, floodgates, drainage pumps and such equipment that are lower than the water level in the reservoir very reliable.

2) The elevation of the drainage outlet of the recycled water pump room should be higher than the normal water level in the reservoir so that water in the reservoir will not flow backwards, otherwise, there should be reliable measures to prevent this from happening.

3) When the flow of water in the recycled water pipes is rapid, the floodgate should not be used. To prevent accidents, besides the floodgates, we should also install appropriate quick-moving valves.

4) If the elevation of the water supply pump room is set slightly higher, its possibility of being submerged by water will be smaller. If the elevation of the pump room has to be at a lower position, we can use vertical water pumps and place electrical mechanisms above the normal water level of the reservoir.

3. Power plants that use sea water for cooling must fully consider anti-corrosion problems. Some generators that have begun operation in the past were not sufficiently treated for anti-corrosion, or the materials selected for use were not appropriate, and serious corrosion of the copper pipes for steam condensers, pipes, valves and water pumps of the cooling system occurred. The experience has to be summarized and further improvements should be made.

(III) Ash

1. We must pay attention to building the ash yard. The ash content of coal used by our power plants is high, the amount of ash released is large, and the degree of comprehensive utilization of ash is low. Because of many reasons, ash yards built in the past frequently could not match the schedule of installation of the generator and they could not be used in time when the generators began production, thus a large amount of ash polluted the rivers and lakes and seas and the surrounding environment. Recently, more attention has been paid to the building of ash yards, but we still need to pay attention to matching their construction schedule with the schedule of construction of the power plant. The amount of work involved in building ash yards is large, it is difficult to procure land, and therefore ash yards must be built earlier so that they can be used in time by the power plant. In building the ash yard, there is another problem worth noting. At present, standards for the construction of embankments of ash yards are not high. The amount of construction of ash yards of power plants being built or yards of renovated old power plants is very large and the cost is high. We need to conduct scientific proofs and study how to lower construction cost.

2. We should stop using concrete pipes as ash scouring pipes. Some years ago, because of a shortage in the supply of steel, since 1971, several dozen power plants have used concrete pipes to replace steel pipes as ash scouring pipes. Except for a few individual power plants that were situated on level land and that operated at a low pressure (used at the end of the pipes), accidents occurred in most power plants. The ash scouring pipes broke and the joints loosened. The amount of money paid to farmers as compensation for damage caused by leaking ash water was large. Such accidents happened many times at the main power plants at Douhe, Lianbi, Huainan, and Huaibei. The cause of accidents involving concrete ash scouring pipes included poor product quality, damage in transport, installation of leaking joints, lack of load-bearing buttresses or improper distribution of buttresses, steep slopes where the hammering force of water was large, and lag in maintenance and management.

In general, the possibility of such accidents is far greater than steel pipes. Also, it is very difficult to treat the concrete pipes in operation when they are damaged or when dirt accumulates inside them. We believe, in the past, because of the shortage in the supply of steel, the use of concrete pipes as a substitute for steel ash scouring pipes can only be a temporary contingency measure. It cannot be advocated as a technical trend. The shortage in the supply of cement today is more serious than steel, and it is no longer necessary to use concrete pipes as ash scouring pipes. Even if the shortage of cement is eased in the future, we should still stop using concrete pipes and return to the use of steel pipes to guarantee safety in power plant operations.

3. Oil-free pumps should be used in the hydraulic ash eliminating system. Now, most ash yards, whether they are ash yards of new plants or newly built ash yards of old plants, are farther away, their elevation is higher, and some are over 20 kilometers from their plants. If ash pumps are used to remove ash over such a long distance, we must build one or several relay pumping stations. Not only is the construction cost high but operation and maintenance will both be difficult. If we use an oil-free pump (Fairbanks-Morse sewage and trash pump), then one station would be enough. The oil-free pump has a high lifting distance, it can transport its contents over a long distance, it conserves water, it conserves steel, it conserves investment, its operating cost is low, and little maintenance work is required. The fact that it uses little water is more significant in northern regions that lack water.

The oil-free pump has already been used by power plants at Luoyang, Hancheng, Bagong and Liyujiang. Although it has not been used for a long time and there are still some problems, in general, it is basically successful. We should popularize its use according to concrete conditions.

II. Problems With Boilers

1. We should prevent electrical cables and coal ash from fire. In the traditional designs of our power plants, many rows of electrical cables are placed on top of the coal grinder (most are control cables). Because spontaneous combustion of the coal dust gathered on the electrical cables easily occurs, and because the anti-explosion gate of the coal grinder produces flames when it explodes, such situations frequently cause the electrical cable to catch on fire. Such accidents have occurred in the power plants at Luoyang, Gaojing, and Qinghe. At the Luoyang Power Plant, electrical cables caught on fire twice and destroyed the boiler control panel. Such an arrangement of electrical cables is no longer used abroad. We should also concentrate on research and improvement.

2. The arrangement of an explosion door of the pulverizing system must consider the safety of people and equipment. In this regard, we have also learned some lessons. At the power plants at Qinghe and Jining, the entry explosion door of the ball grinder exploded. Because the explosion door faced an area where people frequently passed by and worked, spewing flames caused personal injury and death. On the question concerning prevention of personal and equipment accidents caused by the explosion of the explosion door, the "Regulations on Technical Management of the Electric Power Industry" (trial) stipulates: "....the location of the explosion door should be in an area where the air flow and the materials spewed out during an explosion would not hit personnel, equipment, electrical cables or oil and air pipes; otherwise, lead pipes must be used to guide the flames to a safe place." In view of the lessons learned from accidents at these plants, this regulation needs to be implemented well. In addition, according to reports, some nations do not use explosion doors as a means of depressurization in designing the pulverization

system. They increase the structural strength of the pulverization system so that it can withstand the pressure produced by an explosion of coal dust. This requires study and it should be used under definite conditions.

3. Devices that prevent fire from dying out should be installed on boilers to prevent the boiler chamber from damage by explosion. Up to now, domestically produced boilers do not have protective devices to prevent the fire from dying out. Installation of such devices on individual boilers has hindered the ease of operation. In recent years, the fire in boilers has died out and then reignited at more than 10 power plants, causing the boiler chamber to explode. Inspection after the accidents showed that the explosion doors on the boiler chambers were mostly functioning but the boiler facilities were still seriously damaged. To prevent such accidents, we must implement measures to prevent the fire in the boilers from dying out during operation of the equipment, and discontinue feeding fuel into the boiler after the fire has died out. But it is difficult to completely avoid the fire from dying out, therefore, we must consider installing devices on boilers to prevent this from happening. Even when the fire in the boiler dies out, it will not cause the boiler chamber to explode. In recent years, large boilers imported from abroad all have systems that "prevent fire from dying out." Operation proves that these systems can effectively prevent explosions caused by reignition in the boiler after the fire has died out. Concerned units in our nation must actively develop such devices and should use them in designing power plants. We must also modify boilers that have already begun production. However, because of the installation of reliable devices to prevent fires from dying out and because the depressurization factor of explosion doors installed on the boiler chamber is not great, problems of dust leakage and damage to nearby personal safety have occurred. Therefore, foreign nations have improved the structure of the chamber of large boilers and generally do not install explosion doors. We should also study this aspect.

4. We must be careful when using fan grinders. Fan grinders require less investment, they save space, and they consume less electricity, but they are less adaptive than medium-speed grinders to various types of coal, and they are much less adaptive than low-speed ball grinders. In foreign nations, the fan grinder is frequently used when firing bituminous coal or anthracite with better grindability. The use of the fan grinder by some Chinese power plants that fire lignite has also produced good results. But because the types of coal supplied to many of our power plants cannot be fixed, and because the quality of the coal is poor, we must be careful in popularizing and using the fan grinder. In the past, some major power plants have been greatly limited after they began production because the type of coal originally considered in the design changed, because of quality problems in the fan grinders, and because the coal crushers and ferromagnetic separators were not matched. They were even difficult to modify, and operations had to be sustained by relying on mixing fuel oil. Therefore, except for power plants that have a reliable guarantee of suitable types of coal, the fan grinder is unsuitable for the rest of the power plants.

5. The problem of sealing the boilers. In the past, boilers in our nation were set up in the open or housed in large structures. Outdoor boilers are difficult to repair in winter and during the rainy season. In regions of low atmospheric pressure, surface pipes easily freeze or accessory equipment is easily damaged by freezing. The loss from heat dispersion is also large. But construction of large plant structures requires large amounts of civil engineering work and investment. In recent years, enclosed boilers that fire coal have become popular abroad. According to their use by a few power plants in our nation in recent years, they seem to be suitable and they should be studied and popularized.

We must use highly efficient blowers. Blowers, air intake blowers, and dust ventilators of boilers consume about 25 percent of the electricity used as a power plant. But the blowers used in the past have a low efficiency, they consume a lot of electricity, and they frequently have to be rebuilt after they begin operation. According to statistics on more than 2,500 blowers, 56.8 percent of the blowers were originally designed as high-efficiency blowers, but after they began operation, 52.4 percent of them had to be rebuilt. The remaining ones also had to be rebuilt. After being rebuilt, their efficiency generally improved by over 10 percent. The present problem is that the efficiency of some newly manufactured blowers is still low. For example, the efficiency of the centrifugal blower, an accessory of the 200,000-kilowatt generator, is lower than 70 percent, and compared to the efficiency of 84 percent of foreign blowers, the gap is very large. There are no highly efficient dust ventilators yet. Some highly efficient blowers are not serial products and do not provide many choices, and thus the phenomenon of "a big horse pulling a small cart" has occurred, creating a waste of electricity. This problem requires us to cooperate with the manufacturing sector, to absorb advanced foreign experience and the experience of rebuilding domestic power plants in solving the problem so that we can use highly efficient blowers in future construction of new plants to avoid rebuilding after they begin operation.

7. The problems of smoke ventilation and dust removal. In the past, except for a few power plants, the water membrane dust remover was commonly used. This dust remover is relatively cheap to manufacture but its efficiency is low, it uses a lot of water, it easily causes dust to accumulate in the air intake blower, and it vibrates. After installing venturi pipes, the consumption of electricity and water both increased. The use of electrical dust removers is already common on small foreign boilers. We must also exert efforts to improve the manufacturing quality of electrical dust removers and popularize and utilize them conditionally in building new power plants in the future.

III. Problems of Steam Turbines

1. We must prevent the fuel system from catching on fire. The oil pressure in the fuel system of the steam turbine is very high. When oil leaks out or spews out and encounters high temperature metals that are not thermally insulated well, a fire will result. The generator, the control room and even the plant housing may be burned down. Such accidents have occurred many times in the past and a lot of damage has been caused. At present, power plants have implemented some fire prevention measures, such as preventing the oil in the

fuel system from leaking, maintaining the temperature insulating layer of high temperature steam pipes in good condition, and using high-temperature resistant and oil resistant plastics for the pipes of the fuel system. To further prevent such accidents, it is suggested that we learn from the advantages of some imported generators, install the high-pressure pipes of the fuel system inside the low-pressure return fuel pipes to prevent oil from leaking and catching on fire.

2. We should use water supply pumps with hydraulic governors and various types of high-efficiency pumps. The consumption of electricity of various types of water pumps in power plants, especially water feed pumps and cycling water pumps constitutes a large percentage of the amount of electricity used by the power plant. Like the blowers, the efficiency of water feed pumps and cycling water pumps installed and used in the past is low. Many water feed pumps had to be rebuilt after they began operation. In the future, we need to coordinate with manufacturers and use high-efficiency water pumps in newly built power plants. At present, besides the domestically manufactured 300,000-kilowatt generator which uses pneumatic pumps, all others use fixed-speed electrical pumps. Loss in throttling flow is very large, and it is difficult to realize automatic regulation. In the future, we should use electrical pumps with hydraulic governors or pneumatic pumps. This is even more important when the pumps have to perform peak regulation tasks.

3. We should use the rubber ball device to clean steam condensers. This device has been widely installed in domestic and foreign power plants. According to surveys, after a 100,000-kilowatt generator is installed, the increase in thermal efficiency can save 3,000 tons of coal a year, and it can also avoid losses from shutdown or reduced loads caused by efforts to remove impurities in the steam condensers. But now, most of the rubber ball cleaning devices in our power plants have been installed by the power plants after the generators have begun operation, therefore there are more difficulties. Such devices are now supplied domestically as accessory equipment of complete sets, and it is hoped that they can be included in the designs of power plants in the future.

IV. Problems in Electrical Equipment

1. Holes for electrical cables must be tightly sealed. When an electrical cable catches on fire, the fire spreads quickly. A burning electrical cable may destroy the entire main control room. This sad lesson has been learned painfully in several fires that had occurred in power plants in our nation. In recent years, each power plant has learned from such accidents to tightly seal holes for electrical cables in walls or boards of buildings. Practice proves this is an effective measures to prevent the spread of fire along electrical cables. This measure has already prevented several major fires. It is suggested that this measure be used in designs. Some power plants abroad bundle control cables together and house them in steel pipes. This is safe and neat and is worth studying and using.

2. Circuit breakers, knife switches should have locking mechanisms to prevent operational errors. Now, among the accidents of power supply and

generation throughout the nation, a large proportion has been caused by errors in the operation of electrical equipment. We must implement measures in the management system and in technical equipment to prevent operating errors. We have neglected this aspect in the past. Some circuit breakers and knife switches do not have locking mechanisms. Some have locking mechanisms installed but they cannot operate normally. Now, some power generating and supply units have installed locking mechanisms on circuit breakers and knife switches. The results have been obvious. The locking mechanisms installed on some imported generators are also worth studying. It is hoped that this would be given consideration in future design.

3. We must pay attention to prevent accidents caused by dirt contaminating porcelain pins. The step-up substation of a thermal power plant frequently malfunctions when dust in smoke and water drops spewing out from the water tower splash onto less insulated and unprotected parts. A substation of a certain city's power plant was short-circuited by dirt in winter when snow adhered to it. The accident caused a power outage over a large area of this city. There are many accidents caused by splashing dirt contaminating power lines. To prevent such accidents caused by dirt, it is important to clean the porcelain pins. But the present level of insulation is also worth studying. We understand that Shandong Province has implemented specific measures to increase the number of porcelain pins for some power lines or substations to increase the level of insulation. After implementing such measures, large area contamination by dirt that occurred almost annually in the past has been greatly reduced.

V. Problems in the Thermal Power System

1. The problem of the life of the main high-pressure and high-temperature steam pipes. The design life of our main high-pressure, high-temperature steam pipes is 100,000 hours except for pipes of individual imported generators. Now, the number of hours of operation of many generators has surpassed this figure, and the number of hours of operation of some has reached over 200,000 hours. What operating lifespan is the most appropriate? This is still a research topic at present, and at the same time, we must analyze concrete conditions, the thickness of the wall of the pipes, changes in operating temperature, the condition of materials and metals, and the condition of the supports. It is very difficult to make a precise decision. Also, even if we decide to replace the pipes, the amount of work is large. It is suggested that future designs study the problem of prolonging the useful life of the pipes of some imported generators is based on 200,000 hours. The bent section of pipes of some generators has been thickened and thus the useful life of the entire pipe section is prolonged. We hope that the life of the main steam pipes can be the same as that of the generator. In addition, during the previous period, some generators used 10CrM$_0$910 pipes with unqualified wall thickness as steam pipes. This greatly reduced the operating life. It is hoped that such pipes will not be used anymore.

2. The insulating layer should be wrapped with zinc plated iron sheets or aluminum sheets. This has almost become a custom abroad, but we still use cement or glass fiber reinforced cloth now. Although this method can conserve

about 10,000 to 20,000 yuan in cost per generator, the wrapping easily falls off. This is not only ugly, heat loss is increased, and the cost of maintenance is also very high. The total cost shows this is not economical. It is hoped that the insulating layer of the main steam pipes, water pipes and related equipment of newly built generators in the future will be wrapped in zinc plated iron sheets or aluminum sheets. Places that require constant inspection and repair should be wrapped in iron sheets or aluminum sheets that can be easily dismantled.

3. We should improve the arrangement of the oxygen remover and the automatic control of its thermal power system. At present, some oxygen removers are placed right above the main control room. With high-pressure steam entering the oxygen remover and with the many problems present in the safety valve of the oxygen remover and the automatic control mechanism, operation is very unsafe. After the accident at the Qinghe Power Plant, specific improvement measures have been drawn up. Besides efforts to make urgent improvements by the production units, future designs of new plants must also take this into consideration.

VI. Problems in Heat Control

Heat control is a weak link in domestically manufactured large generators at present. The main problem is that many are installed but few can operate normally, thus causing a lack of necessary means for safe and economical operation. This problem involves the quality of the equipment, the design of the power plant, the supply of backup equipment and maintenance and management. The problem must be solved by coordinated efforts.

VII. Problems on the Plant Site and Layout of the Plant

1. We must prevent the accumulation of water in the cable ducts. Accumulation of water in cable ducts is a more common problem. There are many reasons, such as the following: Drainage pipes are placed together with the cable ducts, and when the drainage pipes leak, water is released into the cable ducts. Refilling of earth in the lower ground layer and in the waterproof layer of the cable duct was not done well and thus cable ducts sank, broke or water leaked into them. When cable ducts are improperly arranged, when the layer of drippings from the boiler is scoured by ash, the ash water enters the cable ducts, etc. Accumulation of water in the cable duct not only affects safe operation (at a certain main power plant, the accumulation of water in the cable duct caused a cable "blowout"), it also hinders production. It is hoped that in the design of new power plants in the future, this can be placed at an important position to study and improve it.

2. The problem of lighting, ventilation, temperature reduction in the plant. The designs of the plant housing of Chinese power plants mostly use large glass windows for lighting and ventilation. Glass windows easily accumulate dust and coal dust and cleaning is difficult. After the guide grooves of the steel frame of the windows rust, the windows are difficult to open and shut. At the same time, glass windows easily break, and each winter, when insulating the plant housing to prevent coldness and freezing, a lot of glass windows have to be replaced. According to statistics compiled by the Qinghe

Power Plant, over 2,000 square meters of glass have to be replaced each year. In ventilation and reducing indoor temperature, some power plants have used the side windows near the ceiling in the steam turbine room for ventilation. The windows function only when the direction of air flow is guided. When the direction of the wind changes, the coal dust between the coal conveyer belts is blown into the steam turbine room, and sometimes the windows have to be shut. The indoor temperatures in the shops of power plants in hot areas in summer sometimes reach over 40°C. Ventilation problems cannot be solved by relying on natural ventilation. In addition, as the level of automation of power plants is elevated, such precision equipment as heat controllers and computers require a higher degree of clean air. According to the above situation, many power stations abroad use closed structures, artificial lighting (or partially artificial lighting), mechanical ventilation (or partially mechanical ventilation). There are few glass windows or no windows. In designing plant structures in the future, we should also study the use of these methods according to concrete conditions.

3. We must rationally arrange space and sites for inspection and repairs. Repair work at our power plants is carried out by reserve personnel of the power plants. In the future, power plants with a few generators or large single unit capacity should develop towards centralized repairs but this is difficult to realize at once. Therefore, the designs of power plants should take into consideration unified arrangement and establishment of repair space and sites. Otherwise, after operation begins, small sheds and buildings will be scattered throughout the premise. This is unfavorable for work and it also affects the appearance of the plant.

4. We must add necessary living facilities inside the plant structure. In the past, because this problem was seldom considered (including restrooms, changing rooms, mess halls for operating personnel), and lacked strict management after the plants began operation, clothes, rainwear, backpacks, and lunch boxes of operating personnel were scattered everywhere in the unit control room and they also ate in the control room. This attracted roaches and rats. These have brought about very unfavorable affects to operational safety and production. Therefore, necessary living space must be established inside the main control room and other necessary sites. In addition, now, the ceilings of large generator rooms are becoming higher and higher, and each floor of the room must have the necessary number of restrooms. Otherwise, this will be very inconvenient for operators and repair personnel, and this will affect work progress or be unsanitary.

5. We must build roads, walls and carry out greening work inside the plant premises well. In the past, many power plants did not have regular roads and walls inside the premises even after operating for many years. The plant premises were muddy chaotic. They have created many difficulties in working and living conditions and in maintaining a normal production order. Greening and beautification of the plant premises were not even mentioned. It is hoped that roads and walls inside newly built power plants can be uniformly arranged, designed and constructed, and it is hoped that they can be completed before the plant begins operation. In order to build roads and walls first, the units preparing for production must begin greening work during the course of

building the power plants. To conserve land, the area in front of the plant should not be too large, but it must be practical, economical and pleasing to the eye. Under uniformed arrangement, the front area of the plant must be zoned and the production preparation units should design and organize construction by themselves.

Some opinions and suggestions have been presented regarding some concrete problems mentioned above. We believe that in order to improve the standard of construction of our nation's power plants, the production and operating units must actively shoulder the responsibility of technical information feedback. They should feed back problems that have emerged in production and opinions concerning improvement to the design and construction units and they should also provide information feedback to the equipment manufacturing units. Everyone should cooperate with one heart and mind towards a common goal.

9296
CSO: 4013/23

THERMAL POWER

FLYASH QUALITY, COMPREHENSIVE UTILIZATION ANALYZED

Beijing DIANLI JISHU [ELECTRIC POWER] in Chinese No 10, 5 Oct 82 pp 25-27, 45

[Article by Luo Shuofu [5012 4311 1133] of the Zhuzhou Power Plant, Hunan Province: "Flyash Quality and Comprehensive Utilization"]

[Text] China has used flyash in the building materials and construction industries for more than 20 years. At present, its application and research have already developed into many new areas.

For many years, the quality problem of flyash has not been solved well. Because the types of coal used by power plants frequently change, the combustion process is unstable, the loads of boilers fluctuate and the dust removing facilities are imperfect, the quality of flyash of each power plant and the quality of flyash of the same power plant at different periods are different. Some flyash basically cannot satisfy the requirements for use. This has seriously affected its comprehensive utilization. To make flyash into a resource, we must commercialize flyash and meet a definite quality standard. Therefore, the work carried out by our plant in this regard will be introduced in the following.

I. Control of the Carbon Content in Flyash

Because of the variation in the quality of fuel coal and the differences in the level of operation of the boilers, the content of carbon in flyash of power plants is also different. A survey of 160 thermal power plants of 50,000 kilowatts and more conducted by related units shows that about 30 percent of them produce flyash with a carbon content surpassing 12 percent, about 40 percent of them produce flyash with a carbon content surpassing 8 percent, and the carbon content in the flyash produced by the rest of the power plants is also between 5 and 7 percent. According to estimates, the whole nation releases over 30 million tons of flyash and the amount of pure carbon (with thermal value of 7,850 kilocalories/kilogram) reaches several million tons. This not only creates a waste of coal resources, it also lowers the quality of flyash, creates difficulties for comprehensive utilization and it is unfavorable to environmental protection. Therefore, when the carbon content in flyash is relatively high, we should think of ways to separate the carbon content. This has an important significance in comprehensive utilization and energy conservation.

To solve the problem of decarburization, Belgium, Canada, the Soviet Union have all conducted experiments to retrieve coal from flyash and have realized success.

The Zhuzhou Power Plant fires about 800,000 tons of low grade bituminous coal and anthracite of the province each year. It releases about 300,000 tons of ash. The ash contains a large proportion of coal ash (average A^y above 40 percent), it has a low heat output (average $Q < 3,600$ kilocalories/kilogram), the types of coal frequently change, and the flyash contains a lot of combustible substances, generally from 8 to 20 percent. Therefore, the plant began in 1976 to conduct decarburization experiments for flyash. The several methods of decarburization are described separately below.

1. Decarburization by Flotation (suitable for flyash released by the wet method)

Decarburization by flotation utilizes the energy difference between the affinity to water of flyash and that of coal granules to separate them. When a capturing agent (such as diesel oil) is added to the ash liquid, coal granules which contain less water are soaked and adsorbed by air bubbles produced by mechanical stirring. The air bubbles carry the coal granules upward to the surface of the liquid to form a layer of mineral foam. Draining the foam and dehydrating it produces coal concentrate. At this time, the ash granules that have an affinity to water are drained as tail residue along with the ash water. To stabilize the air bubbles, we need to add a chemical into the ash liquid--bubbling agent (such as mixed oil alcohol, turpentine oil) to reduce the surface tension of water.

In small-scale experiments, when the original carbon content in the ash is 15 percent, flotation can produce a yield of 19.7 percent. The percentage of retrieval of carbon in flyash of coal concentrate with a fixed carbon content of 73 percent can reach 95.7 percent. After screening, the carbon content of tail ash drops to 0.8 percent. The amount of diesel oil used is 0.82 kilograms/ton of original ash, the amount of mixed alcohol and oil is 0.35 kilograms/ton of original ash. Experiments show that the technical and economic indices of the flotation technique to decarburize flyash are good.

To prove the experimental results and to examine the adaptability of the flotation technique to changes in flyash and the technique's stability in long period of operation, the plant built an intermediate experimental shop that can process 30,000 to 40,000 tons of flyash a year in April, 1977. The technological flow process is illustrated in Figure 1.

After 9,000 hours of trial runs, a total of about 9,000 tons of coal were screened. The process operated continuously for a maximum of 2,500 hours. During the trial run, the average heat output of selected coal was over 5,500 kilocalories/kilogram. All of the coal was returned to the boiler for firing. A total of about 40,000 tons of tail ash was obtained from decarburization and the average carbon content was below 3 percent. The ash was used to make bricks and also as a mixing material in concrete and in ceramsite expansion experiments.

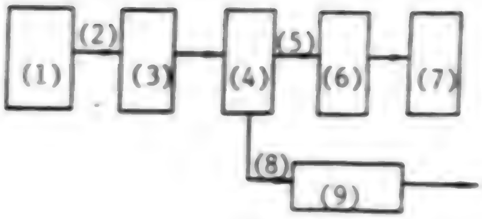


Figure 1. Technological Flow of the Intermediate Experimental Shop for the Flotation of Flyash

Key:
(1) Water membrane dust remover
(2) Ash duct
(3) Stirring barrel
(4) Flotation machinery
(5) Coal
(6) Dehydration of coal concentrate
(7) Coal yard
(8) Tail ash
(9) Ash liquid pump

After operating continuously for 2,500 hours, the reliability of the flotation method was proven. At the same time we discovered that when the coal content in the original ash was low, the performance of the flotation technique was also good. Some of the data are listed below:

Carbon content in original ash: 3.48 to 17.64 percent,
Yield of coal concentrate: 4 to 22.5 percent,
Carbon content in coal concentrate: 62.57 to 82.78 percent,
Carbon content in tail ash: 0.37 to 1.2 percent,
Percentage of retrieval of carbon: 74.86 to 97.07 percent,
Consumption of diesel oil: 0.21 to 1.05 kilograms/ton of ash,
Consumption of oil as bubbling agent: 0.25 to 1.0 kilograms/ton of ash.

Based on small-scale and intermediate experiments, the plant designed and built its own flotation shop that could process 200,000 tons of flyash a year. Its technological flow process is illustrated in Figure 2.

The actual investment in the shop was 650,000 yuan. Calculating at an ability to float 30,000 tons of coal a year, the investment in capital construction could be recovered in 2 to 3 years.

In industrial production, the operating indices of the flotation shop were as follows: the coal content in the original ash was 11.64 percent, the yield of coal concentrate was 13.07 percent, the carbon content in the coal concentrate was 64 percent, the coal recovery rate was 71.9 percent, the ash content in the tail residue after screening was 3.83 percent, the amount of diesel oil used as a capturing agent was 0.8 kilograms/ton of ash, the amount of x oil used as a bubbling agent was 1.2 kilograms/ton of ash. The cost of floating and screening 1 ton of ash was 2.60 yuan (where, the cost of the capturing agent constituted 13.8 percent, that of the bubbling agent constituted 8 percent, manual labor constituted 19.2 percent, the cost of electricity, maintenance and depreciation constituted 59 percent).

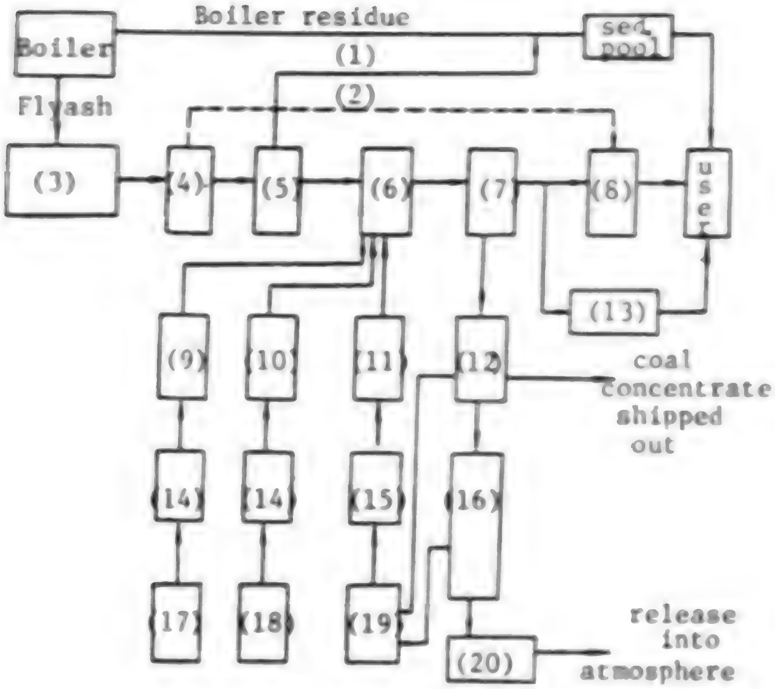


Figure 2. Flow Chart of Flyash Flotation Shop Capable of Treating 200,000 Tons of Flyash Annually

Key:

(1)	Ash liquid conduit
(2)	Clean water overflow to scour residue in conduit
(3)	Water overflow from dust remover
(4)	Condensation equipment
(5)	Sand pump
(6)	Stirring barrel
(7)	Flotation and screening facility
(8)	Ash liquid pump
(9)	High level oil tank
(10)	High level oil tank
(11)	Filtering barrel
(12)	Coal concentrate pool
(13)	Tail ash pool
(14)	Oil pump
(15)	Clean water pump
(16)	Gas and liquid separator
(17)	Storage drums
(18)	Storage drums
(19)	Filtering pool
(20)	Vacuum pump

When designing the flotation technique, we considered the following two points: 1) Ash and residue were separately released to guarantee that the boiler residue does not enter the flotation facility. 2) The flotation facility is used only as a bypass of the available ash draining system. During flotation operations or when not in use, it can guarantee normal drainage of ash. Therefore, it does not affect production of the power plant and it also eliminates the residue crusher (the residue is transported by gravity along the residue crusher (the residue is transported by gravity along the residue duct without passing through the ash liquid pump). At the same time, because the ash water has been condensed by the dust remover, after screening coal, the load of the ash liquid pump is greatly reduced, and in this way, the wear and consumption of electricity of the ash liquid pump are reduced. The power required by the flotation technique is basically the same as the power conserved by the ash liquid pump. After the ash and residue are separately released, the useful value of the residue is greatly increased. The boiler residue of the Zhuzhou Power Plant has already passed through the residue sedimentation pool. The grab bucket lifts the residue and transports it away as mixing material for cement. This has basically solved the problem of the destination of 30,000 to 40,000 tons of residue.

About 30,000 tons of coal concentrates can be obtained each year from the flotation shop. From 110,000 to 150,000 tons of tail ash are provided for the brick factory (annual yield of 70 million to 90 million standard bricks), and another portion of tail ash is treated by split level deposition as mixing material for concrete and mortar used by hydroelectric construction sites and construction engineering companies.

2. Decarburization by Electrical Screening (suitable for treating flyash released by the dry method)

Flyash released by the dry method is more convenient for comprehensive utilization, therefore, the Zhuzhou Power Plant also conducted experiments in decarburization by electrical screening of ash released by the dry method. Electrical screening utilizes the difference between the electrical properties on the surface of flyash and coal granules for screening (the specific electrical resistance of flyash is 10^{11-12} ohm-centimeter, the specific electrical resistance of coal granules is 10^{4-5} ohm-centimeter).

Electrical screening performed well in various experiments. The indices in screening were as follows: The carbon content of the original ash was 21 to 30.75 percent, the yield of coal concentrate was 31.72 to 36.3 percent, the carbon content in the coal concentrate was 60.23 to 81.1 percent, the recovery rate of coal was 87.9 to 90.4 percent, the carbon content in the tail ash was 3.19 to 5.9 percent. After completing industrial experiments, further experiments ceased because there was no more supply of dry ash. At present, an electrical dust remover has been installed and has begun operation. The plant is organizing forces to build a dry ash decarburization shop.

II. Control of Flyash Fineness

The fineness of coal dust used in the suspended coal dust combustion furnace is generally controlled at R_{70} of 10 to 14 percent. When firing varieties of coal with a low volatile content, the fineness may drop to 6 to 10 percent. But because of caking and expansion of coal dust during the combustion process, the fineness of flyash is generally larger than the fineness of coal dust. Therefore, the fineness of flyash captured and gathered is also larger than the standards stipulated by the state.

To enable the fineness of flyash to coincide with the requirements for a mixing substance for concrete and other filling materials, we must control the fineness of flyash.

Zhuzhou Power Plant compared technological processes, selected the blowing technique to screen flyash by degree of granularity. The treatment facility is a cascade type ultrafine screening machine. In small-scale experiments, when the fineness R_{75} of the original ash was 15 percent, the yield of fine products can reach 66.1 percent. The residue from the screen with 80-micrometer square pores was 2.99 percent, the residue of the screen with 40-micrometer square pores was 15.8 percent, the specific surface area was 1,500 square centimeters/gram, the quality of the product completely coincided with the GB1596-79 and the JIS-A6201 standards. The production of 1 ton of product consumes 6.79 kilowatt-hours of electricity. To obtain finer products to satisfy the demands of certain users (such as the plastics profession), the plant also experimented with the technique of rescreening fine ash. The screening indices were as follows: When the screened residue of the original 400 grade ash (a screen of 37-micrometer square holes) was 50.4 percent, the ash was screened again until the fineness of the product showed a screened residue of 3.4 percent for the original 400 grade ash. The specific surface area increased from 2,740 square centimeters/gram to 5,100 square centimeters/gram. At the same time, the spherical granules in the flyash were concentrated in the product and thus the demands of the plastics industry were satisfied.

The results of screening using industrial blow screening machinery designed and manufactured by the plant itself are as follows: When the screened residue of the 80-micrometer screen of the original ash was 35.8 percent, the percentage of yield could reach 38.8 percent. The qualified products from an 80-micrometer screen with a screened residue of 4.8 percent consumes 8.3 kilowatt-hours of electricity per ton of ash.

Experiments show that products screened by blow screening can completely satisfy the user's requirement for fineness, and at the same time, the economic properties are good and the consumption of electricity is low. The plant cooperated with the Zhuzhou Plastics Plant, used the ash from blow screening as the filler for polyethylene, and while guaranteeing quality, every 100 parts of polyethylene resin can be mixed with 80 to 100 parts of flyash. This reduced the cost of plastics products by about 40 percent.

III. Analysis and Experiment of Ways To Utilize Retrieved Coal Dust

The recovery of coal granules from flyash has reduced the amount of flyash released and also improved the quality of flyash, and a lot of coal was obtained. How to fully and effectively utilize this amount of coal is a problem worth studying.

Coal obtained by flotation is fine in granularity and has a low volatile portion, and its specific gravity is 0.6 to 0.7 gram/cubic centimeter. The coal granules are irregularly shaped disks. Under the electron microscope, we can see many small holes on the surface. Most of the coal granules have the luster of coal, they are honeycomb-shaped, some of the coal granules are spherical at the center. When the ash melting point of the original cost is low, a lot of coal-ash conjugates will emerge.

Because flotation screened coal is produced by the power plant, therefore, returning the coal for firing in the boiler would be the most ideal way of utilization. For this, we analyzed the economic properties of returning the screened coal to the boiler for refiring. Each year, the amount of coal that can be retrieved can be calculated by the following formula:

$$q_{fm} = 1.15C_{fh} (1-\alpha_{Lz}) \times \eta_{ch} \times A^{y} \times B$$

where q_{fm}--is the retrievable amount of coal, ton/year;

C_{fh}--average content of combustibles in flyash, taken as 14 percent;

α_{Lz}--the amount of boiler residue as a percentage of the total amount of ash, taken as 10 percent;

η_{ch}--efficiency of dust remover, taken as 80 percent;

A^{y} --average amount of ash of fuel coal as working base, taken as 40 percent;

B --annual consumption of fuel coal. If B is calculated at 800,000 tons, the various quantities substituted into the above formula yields q_{fm}=38,950 tons/year.

When the heat value of flotation screened coal $Q^{y}_{D(fm)}$ = 3,500 kilocalories/kilogram, the ratio between the effective thermal value of 38,950 tons of flotation screened coal and the total thermal value of the fuel consumed by the power plant is $Q_{fm}/Q = 0.0395$. It can thus be seen that flotation screened coal returned to the boiler for combustion can substitute for the production of about 4 percent of the total amount of heat. At the same time, because the cost of flotation is only 8 to 10 yuan/ton, thus even with the addition of a more perfect dehydration facility to reduce the moisture content of flotation screened coal to about 20 percent, the cost would only be 10 to 12 yuan/ton. Calculating at a cost of 19 yuan/ton of firing raw coal by the Zhuzhou Power Plant, the use of 39,000 tons of flotation screened coal in place of 32,000 tons of raw coal can conserve about 200,000 yuan in fuel cost, while the benefits brought about in macrocosmic analysis (such as reducing the amount of shipment of fuel, increasing the utilization value of flyash and environmental benefits) are not even included in the calculation.

Based on the above analysis, we test fired a mixture of 30 percent of flotation screened coal in the TI-35/39 model boiler and we did not discover any visible change in the efficiency of the boiler, but we have not made any conclusions. Later, with the support of the combustion theory research laboratory of the Dynamics Department of the Huazhong Engineering College, we experimented with its hot simulation experimental unit. The experiments showed that under definite conditions, it was feasible to mix flotation screened coal with raw coal return the mixture to the boiler for recombustion.

At present, the Zhuzhou Power Plant has sold flotation screened coal to the brick factory as fuel for firing clay bricks.

In addition, the plant has used flotation screened coal in experiments to produce activated carbon and to desulfurize smoke. The experiments showed that coal retrieved from flyash can completely replace superior quality bituminous coal to produce activated carbon for certain purposes.

Conclusion

1. By controlling the quality of flyash as described above, we can effectively treat the problem of flyash with an overly high carbon content and unacceptable fineness. We can retrieve large amounts of coal and improve the quality of flyash.

2. Separate release of ash and residue in power plants where ash is released by the wet method helps comprehensive utilization of ash and residue and at the same time, it facilitates reducing the consumption of electricity of the dust removal system.

3. We should continue to study the multiple use of flotation screened coal. In order to use flotation screened coal for recombustion in boilers, we need to implement effective measures to dehydrate coal concentrate.

4. The work of decarburization using the dry method requires further experiments in operation.

9296
CSO: 4013/23

THERMAL POWER

SUGGESTIONS ON USE OF LARGE-CAPACITY, HIGH-PARAMETER THERMOELECTRIC GENERATORS

Beijing DIANLI JISHU [ELECTRIC POWER] in Chinese No 10, 5 Oct 82 pp 74-77

[Article by Qiu Changqing [6726 7022 3237] of the Science and Technology Department of the Ministry of Water Conservancy and Electric Power: "Suggestions on the Use of Large-Capacity, High-Parameter Thermoelectric Power Generators"]

[Text] Thermoelectric power is a relatively proved technology. Its technological flow processes have been basically established in a set form. Practice over the past 20 years and more since the mid-1950's when West Germany and the United States began operating their first supercritical pressure reheating generators, which established a new standard in the technology of steam driven installations, shows that unless fundamental breakthroughs are made in the metallurgical technology and manufacturing techniques so that the steam parameters of thermoelectric generators can be increased greatly (this is not practical within the near-term), the efficiency of the generator has already approached the limits of all practical possibilities. Since the 1960's, the average heat loss of the thermoelectric generators of some nations was reduced further mainly via the following measures: (1) the widespread use of large-capacity generators; and (2) renovation of generators of low efficiency. Therefore, for the purpose of using large-capacity generators, the establishment of some corresponding principles and policies will serve a definite purpose in improving the technical and economic indices of electric power production.

I. Domestic Situation

In the mid-1950's China began to install and operate a batch of high-pressure, high-temperature (90 absolute atmospheric pressures, 510° C) thermoelectric generators. In 1968, the first domestically manufactured 100,000-kilowatt generator (90 absolute atmospheric pressures, 535°C) began operation. In the next year, the first domestically manufactured 125,000-kilowatt ultrahigh pressure and intermediate reheating generator (135 absolute atmospheric pressures, 550/550°C) began operation. During the first half of the 1970's, the domestically manufactured 200,000-kilowatt ultrahigh pressure and intermediate reheating generator (130 absolute atmospheric pressures, 535/535°C) and the 300,000-kilowatt subcritical and intermediate reheating generator (165 absolute atmospheric pressures, 550/550°C) began production one after the other. By the end of 1980, a total of 134 large generators of over 100,000 kilowatts were operating with a total capacity of 17.96 million kilowatts, constituting 41.2 percent of the total installed thermoelectric capacity. Because of the batch operation of large-capacity, high-parameter generators, the average consumption of standard coal for generating electricity in electric power production in the 1970's dropped by 50 grams/kilowatt-hour, and in 1980, this dropped 10.8 percent from 1970. During the several years after 1977, the average consumption of standard coal for generating electricity dropped about 10 grams/kilowatt-hour each year. If we take the annual output of thermoelectricity to be 240 billion kilowatt-hours, we can save 2.4 million tons of standard coal each year. For this, the results of energy conservation from the use of large-capacity, high-parameter generators are obvious. Their use may greatly help some major technical and economic indices of our power industry to catch up with advanced world levels.

But under present conditions, the superiority of large-capacity, high-parameter thermoelectric generators has not been fully developed in China's electric power industry and production. For example, the average consumption of coal to generate electricity by the No 1 subcritical pressure 300,000-kilowatt generator at Yaomeng Power Plant in 1980 was 357 grams/kilowatt-hour, close to the average consumption of 360 grams/kilowatt-hour of coal for generating electricity by the ultrahigh pressure 200,000-kilowatt generator of the Zhaoyang Power Plant. The average consumption of coal for generating electricity by the high-pressure 100,000-kilowatt generator without intermediate reheating at the more efficient Gaojing Power Station is only 360 grams/kilowatt-hour. The main reason is that the reliability of the main and auxiliary generator equipment of some large generators is poor, the generators are frequently shut down by accidents, the operating cycle is short, the usability is low, and in addition, because the level of automatic control of large generators in China is not high, because of the poor reliability of the main and auxiliary generators and because the total percentage of automatic control operations is very low, the superiority of large generators in increasing the labor production rate has not been developed.

II. The Situation Abroad and Trends in Development

1. Steam Parameters of the Generators

After World War II, the United States used high-pressure and ultrahigh-pressure generators. By the latter part of the 1950's, it began operating a group of super critical pressure generators, and among them, there were several that utilized second reheating. The operating experience of these generators provided conditions for evaluating generators with super critical parameters, and for selecting the best steam parameters, the best levels of reheating and the best steam parameters. At the beginning of the 1960's, the proportional number of super critical parameter generators rose and by the mid-1960's, it reached a peak. But, accidents involving some auxiliary equipment (such as valves, water feeding pumps) under super critical pressures increased, and they affected the usability of the generators, and therefore, the proportional number of super critical pressure generators dropped. The proportional number of super critical pressure generators among generators placed in operation each year in the United States has dropped from about 63 percent in 1971 to 10 percent at the end of the 1970's. Up to the present, the United States has a total of about 150 super critical pressure generators. As regards temperature, because of the high price of austinite steel and its poor anti-creep properties, poor ability to resist high-temperature corrosion and its poor adaptability to temperature changes, after 1968, the steam temperature of the generators ordered by the United States for thermoelectric power plants did not surpass 566°C, and most had a steam temperature below 540°C, and they mainly used single level reheating.

The reason for the emergence of the reversal in the selection of parameters for large generators in the United States is that, first, generators with super critical parameters were popularized too quickly, operating experience could not be fed back in time and incorporated in the design and manufacturing of the generators. When defects in the generators were discovered, often a fairly large number of generators had already gone into operation. According to statistics compiled by the Edison Electric Society, the usability of super critical boilers in the United States is lower than that of those of subcritical parameters by 3.2 percent, and the percentage of shutdowns of such boilers is as high as 5.4 percent. The second reason is that as the capacity of nuclear power generators in the power network increases, thermoelectric generators have changed to bearing variable loads. In 1979, the results of economic analysis made public by the United States pointed out that when the rate of utilization of equipment is below 65 percent, the total annual cost of the subcritical pressure generator is lower than that of the super critical pressure generator.

In recent years, because of the rise in fuel prices, some people in the United States have proposed the use of second intermediate reheating generators with even higher pressure (about 350 absolute atmospheric pressures) to improve operating economy. This desire is affected by many factors (including whether the government will pursue policies to develop nuclear power on a large scale), and it still needs some time before the situation will become clear.

West Germany was the first nation to use super critical pressure generators, and it has the capability to manufacture this type of generators, but up to the present, there are only four super critical pressure generators of over 100,000 kilowatts. The generators that began operation in the 1970's were all subcritical pressure generators. When fired by bituminous coal and natural gas/heavy oil, the generators use 180 to 185 absolute atmospheric pressures and 535/535 or 530/530°C as parameters. When fired by lignite, they use 165 absolute atmospheric pressures and 525/525°C.

The levels of steam pressure used in the Soviet Union are 90, 130, 240 absolute atmospheric pressures. Generators of 100,000 kilowatts and less use 90 absolute atmospheric pressures. Generators of 150,000 to 200,000 kilowatts use 130 absolute atmospheric pressures. Generators of 300,000 kilowatts and above all use super critical pressure. The steam temperature of the class of generators of 130 and 240 absolute atmospheric pressures originally used 565/565°C. Since the 1970's, this has been changed to 540/540°C, mainly taking into consideration the operating reliability and life of the metals of the boiler and the steam pipes.

Japan's thermoelectric generators with capacities larger than 375,000 kilowatts all use super critical pressure. Because Japan's thermoelectric generators are all manufactured from imported American (some individual generators were imported from West Germany) technology, Japan fully learned the experience and lessons of developing super critical pressure generators of the 1960's in the United States. Therefore, most of the generators newly built since 1974 in Japan use super critical parameters. Japan's fuel relies on imports, therefore super critical pressure and higher steam temperature are used to improve thermal efficiency and reduce the cost of generating electricity. Also according to Japanese reports, Japan's Energy Agency will implement a plan beginning this year to improve the parameters of the coal-fired super critical generators in order to increase the pressure and temperature by 10 to 20 percent from the current levels and thus increase the thermal efficiency of the whole plant to 40 to 42 percent.

Britain and France are now using subcritical pressure and they have a long period of operating experience. They believe such generators are more reliable and economical. The generators of over 200,000 kilowatts in Britain generally use 163 absolute atmospheric pressures and 566/566°C (coal-fired generators) or 538/538°C (fuel oil-fired generators). Generators of 250,000 kilowatts and over in France generally use 166 absolute atmospheric pressures and 565/565°C of steam temperature as parameters, but the steam temperature of the generators of 600,000 and 700,000 kilowatts ordered after 1970 has been changed to 540/540°C. Another reason these two nations do not use super critical pressure generators is that they are not willing to use direct current boilers. Large capacity generators in Britain also have the problem of operating in two shifts.

2. Capacity of Generators

The United States has always led in generator capacity. Since 1950, when a 125,000-kilowatt generator began operating, to 1965, when the first 1 million kilowatt generator started up, the capacity doubled an average of every 5 years. Later, the rate of development in the capacity of generators visibly slowed until 1973 when the first 1.3 million-kilowatt generator began operating. But among the generators that began operating during the latter part of the 1970's, none surpassed 900,000 kilowatts. The average capacity was 500,000 to 600,000 kilowatts. The average capacity of the generators that began operation in West Germany and Japan recently has also stabilized at 500,000 to 600,000 kilowatts. The capacities of the largest thermoelectric generators in France and Britain are respectively 700,000 and 660,000 kilowatts. The Soviet Union began operating its first 500,000- and 800,000-kilowatt generators in 1967, but by the end of 1980, there were only 8.5 million-kilowatt generators and 9.8 million-kilowatt generators. At present, the main generators are 200,000 to 300,000 kilowatts.. Among the newly built generators of the 1980's, the number of 200,000 to 300,000-kilowatt generators still constitutes a fairly large proportion. The number of 500,000 and 800,000-kilowatt generators will gradually increase. The 1.2 million-kilowatt generator was originally scheduled to begin operation in 1975, but as of 1980, there has not been any official reports that it has begun operating.

The above situation is primarily caused by economic factors. The increase in the capacity of generators prolongs the construction period of power plants and creates a slow turnaround of capital. In addition, the economic benefits brought about by increasing the capacity of generators gradually lessens as the capacity increases. According to calculations performed in the United States at the end of 1979, the unit manufacturing cost of a thermoelectric generator with a capacity of 100,000 to 300,000 kilowatts is 30 percent higher than that of a generator with a capacity of 500,000 to 650,000 kilowatts. But when the capacity surpasses 650,000 kilowatts, the unit manufacturing cost of generators is only 5 percent less than that of 500,000- to 650,000-kilowatt generators. When the capacity of the generators fired by lignite surpasses 850,000 kilowatts, and when the capacity of the generator fired by bituminous coal surpass 1.2 million kilowatts, the unit cost basically does not drop further. In addition, the reliability of operation of large generators at present is not as good as that of medium and small generators. When the capacity of the single generator increases, there are also problems of poorer versatility. Therefore, although views still differ as to how large should the appropriate capacity of generators become, at the beginning of the 1970's, debates about using 1.5 million to 2 million-kilowatt capacity class thermoelectric generators were once popular but now such debates have not been heard of anymore.

III. Suggestions on Principles and Policies

The domestic and foreign situations described above show that the selective use of large-capacity, high-parameter thermoelectric equipment is related to the degree of maturity of the design of the generators themselves and (1) the comprehensive economic benefits after use, (2) the technological level and productive capabilities of the metallurgical and manufacturing industries, and (3) the level of operation. These situations must be considered in view of Ching's unique situation. Aimed at the tentative ideas of our nation's present readjustment of policies and near-term and long-term plans, we suggest the following principles and policies.

1. In introducing manufacturing technologies for mainframe thermoelectric power generators, concerned departments have attempted to prove the parameters of the generators, and they have considered all factors. They have decided to use the subcritical pressure (170 absolute atmospheric pressures) and 540/540°C steam parameters. This selection is suitable for the near-term and the mid-term situation in our nation. Taking into consideration the process of digesting and consolidating imported technology, we suggest that these parameters should remain unchanged for manufacturing large reheating thermoelectric generators of 300,000 kilowatts and more before 1995.

2. During the Sixth Five-Year Plan, we should concentrate all efforts on the quality and completion of accessory equipment of mainframe and auxiliary generators of thermoelectric power plants so that the reliability, economic nature, adjustability, durability of equipment can be improved by a larger scale. We must organize forces to digest and quickly transplant imported technology in the design and technology of domestically manufactured equipment to improve the quality of the latter.

3. During the Seventh Five-Year Plan, we must suit measures to specific conditions and use various types of effective technical measures (including dismantling, write-offs) to complete the rebuilding of some medium and low pressure power plants with a low economic performance so that the economic benefits of large-capacity, high-parameter generators can be fully developed.

4. As technical preparation for the power industry, we can consider importing one or two super critical pressure generators during the Seventh Five-Year Plan to grasp their design characteristics and equipment performance, accumulate experience in operation and repair, train a group of technical forces possessing practical experience in super critical pressure generators and establish a foundation for future selection and use of this type of generators.

But whether in the 1990's we will use the super critical pressure generators in the development of our power industry must be decided only after comprehensive consideration of the energy policies at the time, the economic structure, and the level of technical development. Therefore, we should study and prove these factors during the beginning period of the Seventh Five-Year Plan.

5. Unless we develop nuclear power generators or super critical pressure generators within this century, the capacity of large capacity thermoelectric generators installed in batches should be limited to below 600,000 kilowatts.

6. We should remodel and redesign existing 200,000-kilowatt generators to improve their pressure and their economic performance. We should improve the design to adapt to large-scale load variations. The feasibility of operation for peak regulation must also be taken into consideration when designing the new 300,000- and 600,000-kilowatt generators.

7. One of the central problems in managing large-capacity thermoelectric power plants and generators well so that their operation is safe and stable and so that they can develop their economic results is the application of automation. We must determine the level of automation of power plants suitable to our nation's situation so that we can guide the progress in the automation of thermoelectric power plants.

IV. Expected Results

1. We should improve the comprehensive economic benefits and reliability of large generators so that the annual average consumption of standard coal for generating electricity during the Sixth Five-Year Plan can be lowered by about 30 grams/kilowatt-hour (an average annual reduction of 6 grams/kilowatt-hour) by increasing the proportion of large generators and by improving the quality and completeness of mainframe and auxiliary generators.

2. We should lower the annual average consumption of standard coal for generating electricity during the Seventh Five-Year Plan by 25 grams/kilowatt-hour (an average annual reduction of 5 grams/kilowatt-hour) by further increasing the proportion of large generators and by rebuilding medium and low pressure power plants or by retiring them from operation.

3. We should reduce the annual average consumption of standard coal for generating electricity during the first half of the 1990's by 20 grams/kilowatt-hour (average annual reduction of 4 grams/kilowatt-hour) by operating a number of 300,000- and 600,000-kilowatt generators.

In this way, the annual average consumption of standard coal for generating electricity by the year 1995 will drop to about 330 to 340 grams/kilowatt-hour.

4. By the end of the 1980's, about 90 percent of automatic devices of large capacity thermoelectric generators of over 200,000 kilowatts should be in operation.

The above is an introduction to the situation and developmental trend in the use of high-parameter, large-capacity thermoelectric generators in China and abroad. We have also proposed principles and policies which we should implement. As thermoelectric power plants are comprehensive entities of various systems and equipment, we must study every link further and their mutual organic combination to produce the maximum economic benefit from large generators with high parameters. We should overcome the mistaken guiding ideology of the past which "emphasized the key points and neglected the auxiliary points," of unilaterally pursuing single goals and not considering comprehensive and practical results. We should thoroughly eradicate the influence of the "leftist" ideological tide in design, construction, production and scientific research. We should use scientific references to guide each link in the power industry. In the near-term, we must strengthen the manpower arrangement and material conditions in scientific research and experimental units at each level in studying large capacity thermoelectric generators, and improve the scientific research management system to elevate the level of scientific research achievements.

9296
CSO: 4013/23

INDUSTRY GIRDS ITSELF TO MEET HEAVY 1983 PRODUCTION DEMANDS

Beijing SHIJIE MEITAN JISHU [WORLD COAL TECHNOLOGY] in Chinese No 1, Jan 83 pp 2-9

[Article by Yu Hongen [0060 3163 1869], vice-minister of the Ministry of Coal Industry: "Striving To Fulfill and Overfulfill Coal Industry Targets in 1983"--Excerpt from a Report Presented at the National Coal Industry Planning Conference, 21 November 1982]

> [Text] The spirit of the 12th Party Congress resolution and the overall plan of the Ministry of Coal Industry to create new prospects for the coal industry, the guiding thought for 1983 is "Get everything started and push forward together."
>
> Based on this general guideline, in 1983 we should make further in-depth study of the spirit of the 12th Party Congress and steadfastly adhere to it in order to remain completely in step with the party Central Committee. We must carry through the "five speed-ups and one guarantee": Speed up enterprise readjustment and consolidation, speed up the pace of technological improvement, speed up coal mine construction, speed up research and education, and speed up the reform of management systems and economic policy to guarantee that production projects for 1983 are completed and a firm step taken toward new prospects for the coal industry.

The major tasks for 1983 are:

I. Accomplish All Production Targets for 1983

All coal industry workers must be determined to fulfill 1983 production, technological, and economic targets without reservation. We should not only make a good start, but also strive to overfulfill targets for every month of the year so as to increase coal output in a steady manner.

The coal industry has a heavy production schedule in 1983. The first quarter will be the crucial period for fulfilling and overfulfilling the production targets and for creating a totally new prospect in the coal industry. If we procrastenate at the beginning of the year, we will be in a passive situation for the whole year. Production tasks for the first quarter should therefore be met as early as possible. Specifically there are three areas we should work on:

A. Involve all the workers and optimize plans. The plans should be consistent from top to bottom and the goals should be clearly spelled out. Levels of responsibility must be specified to put projects on a solid basis. Workers should be brought into discussions of the plans to stimulate their sense of responsibility and their socialist labor enthusiasm.

B. Cadres should go to the frontline. An important experience in our success in coal production is having cadres go to the front and take the lead. After this meeting, various leading departments shall organize cadres to go into the field to work with the people, to explore and develop potential, to solve problems and help the grass-roots level implement production plans and, together with comrades at the grass-roots level, to work on safety and production construction.

C. Keep attendance up. The first quarter is historically the crucial period for keeping worker attendance up. When a manpower shortage appears on the first line, second line personnel should be organized to support them. We require that the worker attendance rate reach its highest level around the holidays.

As long as cadres, staff and workers in the coal industry maintain a high spirit and work together to solve the problems, we certainly can fulfill and overfulfill the 1983 targets in production, technology, and economy.

II. Accelerate Capital Construction, Improve Quantity, Speed, and Quality

From a long-term viewpoint, a large increase in coal production relies on the construction of new (open pit) mines. To double coal production to 1.2 billion tons, the new shafts and open pit mines to be put into production must produce 400 million tons. To reach this goal in the period of 1981-2000, we must construct 600 million tons of new mine, and put 500 million tons into production.

Because of the long construction time of coal mines, a large- or medium-sized mine generally takes 10 years from ground-breaking to beginning production and this does not even include the preparation time in the early phase. Large- and medium-sized mineshafts to be constructed after 1994 will not make any contribution before the end of the century. In this sense, we have effectively only 12 years to build these new mines. We must therefore fight for time wherever possible and begin immediately to expand our construction scale, speed up our construction pace and, in particular, expand the scale and accelerate the construction of open-pit mines.

The party group in the Ministry of Coal Industry has determined in its study that, beginning in 1983, a policy to put production and construction on an equal footing should be implemented to place capital construction in an important and strategic position. In some provinces, autonomous regions, mining areas, and units, such as major mines in Shanxi, Nei Monggol, Lianghuai, Hanxing, and Yanzhou, capital construction should be placed at the top of the list.

To put capital construction in a strategic position is to improve quantity, speed and quality, to make a major effort in the capital construction management system reform and to make full use of investment and engineering efficiency.

We propose the following six tasks for improving quantity, speed and quality:

A. Beginning now, expand the scope of capital construction and speed up the development of new mines to meet the increased demand on coal after the Sixth Five-year Plan period.

B. Produce marked effects in 1983 to shorten mine construction time. The "8-year war"* approach should not be allowed to continue. The average construction time of new mines should not exceed 6 years. All construction projects should be done under fixed period contracts with awards and penalties. For mines already under construction, the remaining construction time must be firmly fixed on the basis of the "five-fixed" regulation so that they may be completed on schedule.

C. Put major efforts into early phase preparatory work. Experience of the last 30 years has shown that insufficient preparation not only delays completion of the project but also creates waste. In order to achieve increased quantity, a faster pace, and higher quality, major efforts must be made in early phase preparatory work. Large- and medium-sized mines should have a 1-year preparation period and inspections should be done item by item before construction begins, including the formulation and review of construction organization plans. On this basis, each new mine built should have an official ground-breaking ceremony.

There should be personnel specifically made responsible to purchase land and otherwise coordinate work with the public under the unified leadership of local government.

In the process of preparation and construction of the mines, permanent equipment and installations should be fully used when available and large-scale temporary projects should be reduced to a minimum.

D. Thoroughly implement the construction policy of "giving open-pit mines priority" and "combining large, medium and small mines, with emphasis on medium and small mines."

In order to complete the formidable construction task that we now face, a new construction policy must be adopted. Based on the special nature of coal development and on tried-and-true foreign experience, we must take full advantage of China's resources and give open-pit mines priority, especially large open-pit mines that make use of advanced technology, methods and equipment.

In terms of the type of mine, directly administered and direct supply mines are generally too large and the present construction plan still has this tendency. I felt that the selection of mine size is a technical question as well as a question of the guiding ideology. China is in such a urgent need of coal, we must firmly establish the "time and speed" concept and the correct guiding ideology is for the technical work to serve the overall interest.

---

*The 8-year War of Resistance against Japan.

E. Strengthen Geological and Planning Work

The geological bureau of the Ministry of Coal Industry already has a preliminary plan in terms of the direction, emphasis and specific projects for future coal mine geological surveys. Although we now have 640 billion tons of confirmed reserves, not much detailed data for mine construction is available. Given the limitations of regional distribution, transportation, and mining conditions, we do not have a lot of room to maneuver in. In the next 3 years, the major effort in coal survey will be detailed reporting (including hydrological surveys), together with general surveys of mining regions. For the more distant future, we still have time for further study but in any case it should closely match the long-term development prospects of production and construction. Some provincial mining bureaus have proposed the division of geological teams into two parts, one working on production and the other working on resources. This is a good suggestion and we should support it.

Planning is central to capital construction. Good plans can shorten the construction time and produce long-term economic benefits. Wasteful planning leads to the worst wastes. Judging by the requirements of industrial development in coal, more improvements are needed in the quality, speed, and capability of our planning. I hope that all of our planning personnel will learn from past lessons, visit construction sites and production units, absorb advanced foreign experience, further correct the guiding ideology in planning, and firmly adhere to construction policy in order to shorten construction time and develop investment benefits. Design codes should be carefully modified and new technologies should be adopted to produce standard designs.

F. Substantially Modify the Capital Construction System

There are a number of areas in the capital construction management system that require modification; the following items should be worked on in 1983:

Widely adopt the contract system and clearly define economic responsibility, bonus and fines. Medium and small mines should continue the "three contracts, three guarantees" policy and the practice should be extended to include coal mines producing 900,000 tons a year or more. Other single item projects should also follow this policy whenever possible. For these single item projects that cannot practice "three contracts, three guarantees" for the time being, they should first implement fixed length contracts and contract out unit jobs wherever possible.

When new mines are built in old mine areas, the construction should in principle be led by the mining bureaus. The construction work force, under the centralized assignment of the state, should progressively become more specialized and take charge of some pilot projects.

For geological survey, design, construction and production, there should be well planned and directed overlap. The construction and production of large coal mines should be done in stages. The practice of having production crews prepare the mining area ahead of time as in Panji No 2 mine should be promoted in order to save time and produce coal as early as possible.

III. Speed Up Technological Improvements in the Coal Industry

We should speed up the pace of technological improvement in the coal industry and transform backward technology into advanced technology as soon as possible in order to realize the "five transformations."

In 1983 more progress is needed.

A. Continue To Do a Good Job in Improving Mining Technology

To increase the production of existing coal mines we have to rely mainly on technological improvement and adopt new techniques, new methods and new equipment. Theoretically speaking, there are not in the development of mining technology and production increases as possible as long as the mine still has a certain amount of reserve. In terms of achievement, most coal mines in their normal production stage have increased their production in the last 30 years. Examples are the coal mines at Datong, Kailuan and Jixi. Before using combines, it was unimaginable to design the annual production of a work as 200,000-300,000 tons, but today some of our workfaces produce more than 1 million tons a year. This is the result of technological improvement.

The state has recently approved an increase of 2 yuan per ton for the maintenance fee of coal. The party group in the Ministry of Coal Industry further determined that 1 yuan should be used for renewal and aquisition of comprehensive mining machinery and 1 yuan should be used for technological improvement. In formulating an improvement plan, advanced techniques, methods and equipment should be selected whenever possible to make an impact on mining technology. Attention should be given to the compatibility of operations and production ability in and outside the mineshaft. While striving for greater production, effort should also be made to expand product variety and quality and to improve the overall economic efficiency. Regionally, the East should have high priority.

B. Mechanize Coal Mining and Shipping

The principal approaches are:

1. Make good use of available equipment and use it more efficiently. The utilization rate of comprehensive mining equipment should be increased from the present 50 percent to 60 percent, and that of general mining equipment should be increased to about 50 percent.

2. Further develop integrated mechanized mining; 22 sets of comprehensive mining equipment should be replaced or acquired in 1983. All links--from equipment manufacture to down-shaft installation and use--should be handled in a conscientious manner.

3. Actively develop high-quality general mining. Forty sets of high-quality general mining equipment should be put into operation in 1983 and the production per workface should reach 200,000 tons or more a year.

4. Develop heavier, more reliable thin seam extraction machinery. Prototype certification and industrial testing should be conducted in 1983 in order to improve the ratio of thin seam and thick seam mining.

5. Speed up tunnelling mechanization. To improve the workface yield, 200 mechanized tunnelling teams, 60 sets of solid and tunnelling equipment, and 30 new solid road tunnelling operations should be completed in 1983.

6. Improve underground transportation capability. Develop 150 trough belt conveyors and improve transportation facilities for 100 blast workfaces.

7. Improve the supports and popularize metal supports and other advanced support methods. Install 100 anchor guns and develop 500 kilometers of metal hangers of various types.

To make sure that comprehensive mining and high quality general mining maintain their production schedule, the various coal mining equipment plants in charge of manufacturing must guarantee quality and quantity and make delivery according to the contract schedule. In addition, the plants must guarantee the supply of spare parts, provide assembly charts for maintenance use and provide good technical service.

Through the efforts enumerated above, mining mechanization should be improved from the present 40 percent to 42 percent in 1983 and tunnelling and transport mechanization should be raised from the present 40 percent to 43 percent.

C. Improving Production Safety Measures

The emphasis in production safety are the "five preventions, two improvements," namely, gas prevention, dust prevention, explosion prevention, fire prevention, water prevention and treatment, and improvement in ventilation systems and rescue methods. In addition, roof management and transportation management should also be upgraded in order to achieve safe production.

1. Gas Prevention

Nine new gas pumping systems are planned for 1983. The volume of gas pumped was 277 million cubic meters in 1980 and has been increased to 320 million cubic meters.

2. Dust Prevention

Besides precautions taken by individuals, the task is principally building sprinkler systems for general dust prevention. Twelve new systems will be built or completed in 1983.

3. Explosion Prevention Equipment in Mine Shafts

Concentrate on mining equipment and electrical power systems in mines with high methane concentrations in order to meet explosion prevention requirements as early as possible. After that, explosion prevention of machinery and electric equipment at all mines with methane gas may be.

4. Fire Prevention

Based on the conditions of the coal seams, there are 84 mines that require fire prevention grouting system to be built or completed; 17 of these will be worked on in 1983.

5. Water Prevention

Based on hydrological and geological surveys, mines seriously threatened by flooding should complete their safety precautions. Forty-three projects to prevent flooding are scheduled for 1983.

6. Improve Mineshaft Ventilation Systems

In 1983, we should concentrate on improving the ventilation system of 33 coal mines. Mines with improved ventilation should also upgrade their facilities for cold weather.

7. Improve Rescue Methods

Rescue equipment should be gradually upgraded to form rescue teams with more advanced equipment and capability.

8. Strengthen Supports and Roof Management

Inspection and certification should be made more rigorous to assure engineering quality. Power supports, unitized power supports and contractable arch supports should be promoted, and roof pressure monitoring should be developed to observe roof pressure and prevent roof-related accidents.

9. Improve Transportation Conditions

Progressively complete safety protection equipment for the horizontal and vertical movement of personnel.

10. Concentrate on the safety equipment and technological improvement of 10 coal mines to serve as model mines for safe production. In 1983, two or three mines should be equippped with imported safety facilities.

In addition to improving safety measures, great efforts must be made to conduct safety training. Based on the needs of modernized production, various units should systematically conduct formal safety training for all personnel. Three training centers and several silicosis clinics should be established in 1983. Most importantly, safety production management, safety checks and inspections must be intensified in the future. Major gas and coal dust explosion incidents should definitely be eliminated, roof and hauling related incidents should be greatly reduced and the number of silicosis cases should be steadily reduced. Various safety production post responsibility systems should be established and the policy of "safety first" should be thoroughly implemented from ideology, organization and action. The fatality rate per million tons of state operated coal mines should be reduced by 15 percent in 1983 as compared to 1982.

D. Improve Mining Technology and Update Old, Obsolete, and Nonstandard Equipment

In the improvement of mining technique, solution to problems of resource loss and low recovery rate should be emphasized in order to alleviate the shortage in the mine field and prolong the service life of coal mines.

1. In low-gas mines with gently inclined seams or inclined seams and open-structure roof, permission should be sought from the administrative departments to promote column-free mining and take active safety measures. This should be tried in high gas mines with volatile seams.

2. Take various safety precautions and promote "three-down" mining to release the dead volumes of coal.

3. Make further improvement in mining methods, actively promote inclined long wall mining, develop mining machinery for thin seams and power support for thick seams, and make breakthroughs in mining technology for extra thin and extra thick seams and steeply inclined seams.

4. Strengthen management of geological reserves and make recovery rate an important target for evaluation.

Update old, obsolete and nonstandard equipment, plan to update 3000 main water pumps, 200 main fans, 1,300 compressors, 200 steam locomotives, 439 geological drilling machines and other power and communications equipment. This updating could save 500 million kilowatt-hours of electricity and 300,000 tons of coal each year.

In addition to the four areas discussed above, technological improvement must also be made by plants (coal dressing plants, machinery manufacture plants, machinery repair plants, explosives plants, building material plants, etc), capital construction units (well drilling, mine construction, building construction, road construction, etc), geological teams, research institutes and universities and colleges.

IV. Making a Major Effort To Develop Local Coal Mines

To realize the strategic goal of doubling the coal production by the end of this century, the local coal mines must assume a production responsibility of 500 million tons. To this end, we must continue to adhere to the policy of "walking on two legs" to fully galvanize the enthusiasm of state-operated mines at all levels while concentrating on the development of local coal mines. The momentum of boosting production in 1982 (a net increase of 14 million tons) should be maintained to the end of this century. The development of local mines relies on policy and science. We should take full advantage of China's broadly distributed coal resources and proceed to develop and improve at the same time.

Based on the guiding ideology of striving to fulfill and overfulfill coal industry targets in 1983, local coal mines should concentrate on the following five tasks:

1. Complete and improve the policy to assist local coal mines.

2. Improve the technology in existing mines according to the principle of "rational layout, optimum location, rigorous standards, and improved efficiency."

3. Establish a development fund and expand the scale of construction.

4. Work on production safety; rectify deficient safety measures.

5. Continue to promote the economic responsibility system and improve economic efficiency.

V. Continue To Consolidate Enterprises and Speed Up the Pace of System Improvement and Economic Policy Improvement

A. Continue To Consolidate the Enterprises

This includes the following tasks:

1. Continue to work on the first batch of enterprise and business units slated for 1982, completely solve the leadership problem by the end of 1982 and strive for the completion of the "five tasks." A unit may be considered to be consolidated when its inspection work and leadership are strengthened, its labor organization is put in good shape, its economic responsibility system is established and perfected and it has made plans to achieve the "six-goods." On this basis, these units may proceed with their "three constructions" and strive to achieve the "six-goods" standard.

2. Work on the overall consolidation of the second batch of enterprise and business units. The Ministry of Coal Industry has already sent out its second group of investigators to the grass-roots level to help the provinces in the consolidation of the Kailuan mining bureau, the Yanzhou mining bureau, the Huaibei Qinglongshan coal dressing plant, and three plants in Fushun. Second phase consolidation should begin with shaping up the leaderhsip and establishing long-term plans for enterprise improvement and then gradually go from there.

3. Units that have already completed leadership consolidation should devote a major effort to improve their technology and gradually adopt new techniques, new methods and new equipment. They should adhere to labor discipline and labor organization improvement, organize production based on fixed quota and personnel, establish and perfect the economic responsibility system, properly handle the relationship of the state, the enterprise, and the worker, conduct all-personnel training, improve the cultural and technological standards of the workers, rectify the financial and economic discipline and establish a sound financial accounting system.

B. Improve the Management System and Policy

To improve the management system, we must break down regional and professional boundaries and gradually achieve joint operation between central and local regions, between provinces short of coal and provinces rich in coal resources, and between the coal industry and the electric power and chemical industries. The policy should encourage coal-exporting provinces to produce and export more coal and encourage coal-importing provinces to develop more local coal mines. Coal exported beyond quota should be suitably raised in price. Mining with local capital should be promoted. Coal production and sales should be centralized in order to put the three indivisible aspects--production, transportation and sales--closely together. Management of coal products should be strengthened and the distribution plan followed closely. Coal-exporting provinces should make sure the export plans are completed and the quantity and quality of coal are guaranteed.

Business management should be upgraded to further improve the economic efficiency. In terms of enterprise operation policy, the operation should be gradually transformed from pure production type to production and operation type, from simple operation to multiple operation and from one product to a variety of products so as to improve the economic benefits. For this reason, coal dressing and screening should be actively developed in order to improve the quality of coal and to diversify the variety of coal. Mining regions should be encouraged to take out loans and make full use of low heat content fuel and develop their own thermoelectric plant. Mining bureaus with a production greater than 10 million tons may develop 50,000kw thermoelectric stations. Major efforts should be made to develop coal forming, cement, waste rock brick, and ferric sulfate recovery and to actively support the development of urban gas supply and other chemical products to provide jobs for youth waiting for employment.

C. Adopt New Economic Policies

The following reforms will be tried out or implemented in 1983:

1. New economic policies will be adopted according to the nature of the enterprise and management structure. For example, production and profit dual responsibility will be implemented for profit-making enterprises and production and loss dual responsibility will be implemented for enterprises with a loss. Profit or loss above and beyond the contract will be principally the enterprise's responsibility. A production and profit progressive increase arrangement may also be tried out in some enterprises. No matter what scheme is decided upon, it should remain unchanged for several years to maintain the stability of the policy.

2. In the area of cost financial management, one or two units may be chosen as "standard cost" test points on a study basis. Capital should be used creatively and collectively.

3. In the area of wages:

a. Reform the labor system, change the simple fixed labor system into a system where fixed labor, rural agreement labor, external contract labor, and temporary labor coexist. Coal mines may adopt a number of these labor systems according to their actual situation and within the realm of labor project targets.

b. After the Ministry of Coal Industry consults with related departments, we may try out a projected wage scheme where, based on the production construction needs, increases in labor target will be predicted and local unemployed youth will be absorbed as preparatory labor. They will be in a work-study program to learn production techniques and receive a cost-of-living allowance. Examinations will be given in the second year of recruitment and those who qualify will be employed.

c. Based on a fixed quota and fixed personnel production organization, a fixed total wage scheme will be tried out where the enterprise reduces the number of employees but not the total amount of wage and the remaining wages will be for the use of the enterprise. One or two units will be chosen as pilot projects to gain experience before promoting it as a general practice.

d. Expand enterprise use of bonus money. Bonus money from coal tonnage and material conservation will all be allocated to the enterprises for their use.

4. Business departments will continue to practice budget responsibility.

D. Place Major Emphasis On The Big Enterprises

Comrade Zhao Ziyang has repeatedly instructed us that in order to improve economic benefits and speed up economic construction, we must concentrate heavily on the large enterprises that affect the national economy as a whole. Experience at the Beijing Steel Company has shown that the initiative of the enterprise and the workers can be fully mobilized and potentials can be continuously developed to make greater contributions to the state as long as the enterprise has a strong, sound leadership to thoroughly implement the new economic policies made since the Third Plenum of the 11th Party Central Committee, strengthen the business management, handle the relationship of the state, the enterprise and the worker and speed up technological improvement.

The State Economic Commission has recently issued another bulletin calling for improvement of the major enterprises as the main emphasis in the economic effort, technological improvement and system reform. We must put together a complete scheme consisting of enterprise consolidation, system reform, technological improvement and development plan formulation and create a new prospect for improved economic efficiency.

E. Speed Up Development of Education and Coal Science and Technology

To realize the strategic goal set by the 12th Party Congress, we must rely on science and technology and speed up intellectual development. This is the strategy of the party Central Committee. Science, technology, and education have been falling behind in the coal industry, a situation which has not been fully appreciated for some time. Now that we have realized this backwardness, we must move fast and make a good start in coal science and technology and education.

The policy for developing coal science and technology is that "research should face production construction, which in turn relies on scientific research." Only then can development in science and technology be transformed directly into production force. To combine scientific research and production, development plans for coal science and technology must be formulated according to the overall development plan of the coal industry and major consulting problems in coal production must be solved in order to move ahead.

For major projects, departments of research, production, design, capital construction and machinery manufacture should be combined to form a consortium in which economic and technological responsibilities of each department are specified by contracts and all departments contribute to the solution of hard problems. The major emphasis in 1983 will be on high power mining machinery, tunnelling machinery, drilling rigs, explosion-proof battery vehicles, 4.5-meter comprehensive mining machinery and gas and coal dust automatic monitoring systems. Mining techniques for extra-thin and extra-thick seams should be particularly emphasized.

Research units should hire production unit veterans as advisors, expand their consulting, and provide testing methods for production and construction. Bureaus and offices of the Ministry of Coal Industry will organize and promote well-researched results and emphasize their technological and economic benefits.

Research resources at the coal institutes and in the society should be fully mobilized to overcome problems in multidisciplinary projects. Each institute of higher learning must join with one or two production units to form research and teaching bases. The production units will provide the field, propose the topics and sponsor part of the funding; the institutes and universities will then help the production units solve crucial technical problems and conduct technical training. This cooperation should be organized in this meeting. In order to promote research at institutes and universities, the Ministry of Coal Industry is prepared to come up with some research money beginning with 1983. The effort on domestic and foreign technical information should be strengthened and advanced foreign technology should be imported to become part of our capability.

We shall spend 3 years starting 1983 to complete buildings and teaching facilities at 13 coal institutes including the Beijing Coal Management Cadre College established in 1982. The quality of education should be improved and the specialty readjustment should continue. In addition, efforts should be put into secondary vocational schools and correct the improper ratio of higher education and secondary education. College and secondary school enrollment will be increased in 1983 to reach a level of 4,620 and 6,000 students respectively, that is, 1[illegible].2 and 11.1 percent more than the 1982 enrollment. The size of technical schools will be systematically enlarged in 1983 to satisfy the needs of the coal industry on specialized technology. In the meantime, supplemental cultural and technical classes should be held for young workers.

Cadres should be given vocational training. Coal bureaus and coal industries should continue to do a good job on cadre schools and train the cadres in shifts. The development of vocational schools, television universities, correspondence colleges and spare time universities should be actively pursued. Special efforts should be placed on televized teaching. Using Beijing as the center, software should be made available to the major mining zones so that closed-circuit televized instruction may be achieved.

The entire coal industry should be concerned with the secondary and primary education in the miningareas. Solve the teacher problem and the building and teaching facility problem by various means and strive to improve the teaching quality. This is a major issue that will have an impact on the stability of the workers' ranks, the reserve forces of the coal industry, and the image of the coal industry.

VII. Seriously Improve Ideological and Political Work To Meet the Needs for Creating New Prospects

The development of a new situation in the coal industry must rely on a strong ideological and political effort. Based on the new development characteristics of the coal industry and based on previous experience, we must create new experience, new method and new approach in the ideological and political effort and open up new prospects. Under the leadership of local party committees, the coal industry must strive for a stronger ideological and political effort in 1983.

First, we should continue to study the 12th Party Congress papers, conduct various study groups and learning groups so that the learning activity of party members and cadres will lead the way for the vast workers.

Second, continue to follow the spirit of the March 1982 convention of coal industry model workers, promote learning activity and open up socialist competition to learn from and overtake the advanced.

Third, adopt new methods and new measures to strengthen the political ideological education of the workers.

Fourth, straighten up the practice in the party and in the mine. The 12th Party Congress called for better social and party practice, coal industry leaders and all Communist Party members should do their share.

Finally, be concerned with the wellbeing of the workers. Build miner housing using various funds. Devote a major effort to develop versatile business, create job opportunities, develop service companies and collective enterprise companies, provide jobs for miners' children and the surplus labor force. We should also improve medical and health services for the miners, upgrade the quality of medical service, and improve the health of the workers.

Based on the guiding ideology of "striving to fulfill and overfulfill targets," I hope that all the systems and departments in the coal industry will make their standards higher and their requirements more rigorous, and strive to achieve the "five speed-ups and one guarantee" so that we may really be on our way to creating new prospects.

9698
CSO: 4013/109

COAL

MINISTER UNVEILS GRAND STRATEGY TO REVAMP COAL INDUSTRY

Beijing MEITAN KEXUE JISHU [COAL SCIENCE AND TECHNOLOGY] in Chinese No 10, 25 Oct 82 pp 2-4

[Article by Gao Yangwen [7559 2254 2429], minister of coal industry]

[Text] The 12th Party Congress has decided on a grand strategic target to quadruple China's industrial and agricultural annual total production value and improve the standard of living of the people by the end of the century while continuing to improve economic efficiency. In order to reach this goal, it is anticipated that coal production must double; in other words, production in the next 18 years must equal the production of the past 30 years.

There are many difficulties and problems in reaching this goal: 1) Coal production is unstable and unsafe, equipment is backward, and mining is labor intensive and low in efficiency; 2) The price of coal is low, the standard of management is poor, many enterprises are losing money, and profits are low in the few enterprises that are not losing money. The coal industry has no resources for technological improvement; 3) The scale of capital construction is small, the pace is slow, and the rate of new mines coming on line is far below the need for increased output; 4) The cultural and technological standards of the staff and workers are low, there is a shortage of engineering and technical staff and a shortage of strong under-the-mine crews; 5) Economic policies are not on solid bases and cannot effectively mobilize the initiative of local and enterprise-operated mines and the staff and workers; and 6) Coal mined in the west and north must be transported to the east and south. Large amounts of coal mined within Shanhaiguan are shipped out of that region. There is a great shortage of transport and coal mined in the west cannot be hauled out.

In order to accomplish this formidable task and solve these problems, our guiding thought is to inspire our enthusiasm, change our working style, do our best to open up a new road and try in every possible way to develop the coal industry so as to meet the needs of the national economy. Based on the ten policies of China's economic construction and historical experience and lessons learned by foreign nations, we have made extensive surveys among the staff and workers and listened to experts' opinions. After repeated contemplation, discussion, expansion and modification, the preliminary proposal of our new road will require the following: a stable rate of growth (not large fluctuations, but steady long-term growth), healthier development (rational layout, coordinated proportion, advanced approach and improved staff quality), safer construction and production (we cannot afford to pay a high casualty price as we did in the past), better economic efficiency (the construction must be fast and the investment results must be good, the quality and variety of coal products must be improved, integrated processing and utilization should be developed, and management, economic efficiency of the enterprises, energy conservation, and overall benefit to the state must all be improved.

In order to realize these basic requirements, our coal industry must accomplish the following six changes in the next 10 to 20 years:

1. Major coal mines must switch from relying mainly on manual operation to relying mainly on mechanized operation, and thereby greatly improve labor productivity.

2. A fundamental change in safety conditions, basically putting the occurance of major accidents and occupational diseases under control and changing the image of coal mines.

3. Change from single product operation to multiple product operation and develop toward gasification and liquefaction.

4. Change from a single business operation to a multiple and comprehensive business structure. Develop joint coal power and coal chemical enterprises.

5. Switch from small-tonnage car and small horsepower locomotives to large-tonnage coal trains, automated loading and unloading, and slurry pipelines.

6. Change from purely administrative management to a combined administrative and economic management. Mobilize the initiative of local and enterprise-operated coal mines and the production initiative of the staff and workers by establishing rational economic policies, improving the system structure and carrying out the economic responsibility system.

To follow the new road of developing the coal industry, these 12 specific policies must be carried out thoroughly:

1. Systematically Carry Out Technological Improvements in the Mines and Fully Develop the Role of Existing Coal Enterprises

During the Fifth Five-Year Plan, the unified distribution mines expanded their production ability by 47 million tons through developing potential, improvement and consolidation. These measures yield quick results at modest expenses. In the future, technological improvements should be conducted for mines with abundant reserves and convenient transportation to expand production power. The major goals in technological improvements are:

(1) Extensively mechanize the mining and transporting of coal, actively develop the mining of high-grade coal, steadily develop integrated mining, attempt to develop mechanized mining of thin seams, and substantially increase the extent of mechanization of unified distribution coal mines. In view of the technological and economic standards in China and the need to direct excess rural labor to work at the coal mines, local medium and small mines will still rely mostly on manual operations for some time to come; but gradual mechanization should still be implemented.

(2) Improve the mining techniques and replace old, obsolete and nonstandard equipment.

(3) Improve the safety in production.

(4) Make a serious effort to improve the overall mining technology and concentrate the resources to improve 31 major coal mines in 2-3 years.

In order to fully develop the roles of the current coal mines, appropriate technological and economic policies should be studied and established, based on the characteristics of the available mines, to maintain simple reproduction and content expansion reproduction.

2. Speed Up Coal Development, Shorten the Construction Period and Fully Develop Investment Efficiency

After the Sixth Five-Year Plan, the growth in coal production will rely primarily on the construction of new mines. For this reason, the foremost task is to expand the scale of construction.

The layout must be sensible and short-term and long-term considerations should be properly coordinated. The emphasis will be placed on the development of coal mines in Shanxi, eastern China, northeast China, Hebei, Henan, western Guangxi and northern Shaanxi. Major construction projects will include the development of open pit mines at Kuaihelinhe and Yuanbaoshan, continued build-up of "Liang Huai," Yanteng, and Liupanshui and also the construction of some mainstay coal mines.

We must be determined to speed up the construction of mine shafts, shorten the construction time, build large coal mines in stages for earlier production and improve the design to reduce excavation rate.

3. Develop Local Coal Mines Wherever Possible, Especially Where Coal is in Short Supply and Resources are Available

In 1981 the production of local coal mines amounted to 46 percent of the total coal production in China, becoming an important part of the coal industry. In the future, the key to the promotion of local coal mine development is policy. The four policies of the state council regarding coal mines--loss compensation, appropriate tax relief, increase in capital construction investment, and technological improvement funds--should be thoroughly carried out. Encouragement should be provided for above-quota local coal in terms of price. In the meantime, a good fraction of co-op coal and economy coal in Shanxi and Henan should be systematically transformed into unified distribution coal and be included in the plan and the local coal mines should be correspondingly compensated. The development of local mines, especially commune and brigade mines, should have an overall plan to prevent unplanned mining and resource damage.

4. Put Major Efforts Into the Development of Coal Washing and Dressing, Processing, and Integrated Utilization and Change the Product Structure

The washing to dressing ratio of coal must be improved to increase the dressing rate from 34 percent in 1980 to 43 percent in 1985 and 56 percent in 1990. Coal shaping and processing should be promoted, especially commercial honeycomb coal, coal briquets and shaped coal for locomotive use. Coal gasification and liquefaction tests must be properly handled. Actively support mining cities in their development of gasification and the transportation of gas, coke, chemical fertilizer and other products from the coal mines. Comprehensive utilization based on coal waste rock, coal dressing by-products, and mineral intergrowth mines should be developed.

5. Carry Out and Improve Various Economic Responsibility Systems

Because of the importance of the coal industry, unified planning, distribution, and pricing should be emphasized more than in other industries, but in the meantime, it is even more essential to mobilize the initiative of the enterprises. Based on the nature of coal production, the following measures should be implemented:

(a) expand enterprise autonomy by implementing production and profit (loss) dual assignment; (b) assignments must last several (3 to 5, say) years; (c) production assignment quotas must be based on the verified general production capability; and (d) take into account the interests of the state, the local area and the enterprise. Production projects must be uniformly allocated by the state; suitably increase the price of the above-the-quota production and the increased revenue should be mostly retained by the enterprise. Profit and loss should be prorated but they are principally the enterprise's responsibility.

Within the enterprise, a floating wage system that links production to pay and responsibility to rewards should be implemented.

6. Make Liberal Use of Foreign Investment and Fully Develop Domestic Investment

In order to expand the scope of construction and speed up mining improvements, a variety of investment sources should be developed. We must adhere to the correct policy of being open to foreign investment and make active use of it. In the meantime, domestic investment should also be fully developed. Domestic investment will come mainly from regions short of coal. The Ministry of Coal Industry has proposed "Tentative Rules for Raising Domestic Mining Capital." To date, the ministry has signed contracts with 11 provinces, municipalities and counties and has raised some capital. This capital will be used mainly to improve current producing shafts and also to build a number of modern new mines to guarantee investors a supply of coal. The use of the capital, the supply of material, and the distribution and transportation of the coal produced will all be included in the national plan and arranged under overall consideration.

7. Cooperative Management of the Regions, Departments and Enterprises Must Be Done Well

Intraregional cooperative management is mainly between provinces and regions short of coal and provinces and regions with abundant coal resources; interregional cooperation can also be organized under certain conditions of resource distribution. Another cooperative management scheme involves departments and enterprises such as coal and electric power or coal and chemical industries. The Datun coal and power company now being organized is not only an inter-enterprise co-op but also an inter-regional co-op. Such arrangements must be implemented stepwise and improved upon based on the national system and plan and distribution, investment and price.

8. Adhere to the Policy of "Safety First"

Safety conditions are a big issue in changing the image of the coal industry and the future of the industry hinges on it. In the future, while strengthening management, we must work on major safety equipment (some should be imported), safety training of the staff and workers, and fundamentally control disasters and reduce fatalities and injury.

9. Take Effective Measures To Strengthen the Mine Workforce

Upgrade ideological and political work and educate the staff and workers to establish a devotion to the cause of the coal industry.

More effective policies are needed to consolidate the ranks; such as, improving the benefits of mines, implementing a labor system in which permanent workers and contract workers coexist, solving the children education problem and housing problem of miners, and resolving the question of substituting administrative work with labor for the cadres.

10. Strengthen Intellectual Development and Improve the Scientific, Cultural, and Technological Aptitudes of the Workers

This is a fundamental task in speeding up the development of the coal industry. Two things need to be done. First, we should have decent institutes of higher learning and secondary vocational schools in the coal system. In the meantime, resources of the society should also be used in the training of technical personnel, as well as television universities and various spare-time colleges. By 1985, the ratio of technical personnel to business personnel should be increased from the present 2 percent to 3 percent, reaching 4.2 percent by 1990. The second task is to make a major effort in staff and training, organize some good technical schools and give the technical workers one round of training during the Sixth Five-Year Plan so that the technical level is raised by one grade overall and by two grades in some cases.

11. Forging Ahead With Coal Research

Organize forces to conduct research on key technological problems in current production construction and in long-term development, especially major technological improvement, mining base construction, safety equipment, and economically important items in mechanization.

Existing research results should be coordinated and systematically improved upon. Promotion and extension work should be done well so as to play its role in production construction as soon as possible. Resources should be organized to do the job thoroughly until some results and benefits are obtained.

Imported advanced technology should be learned, digested, absorbed and used.

12. Solve Coal Transportation Problems by Coordinating Planning and Construction With Railroad and Communications Departments

(1) The Ministry of Coal Industry has proposed specific suggestions for constructing and modifying some major railroads. The ministry is also actively collaborating with the Ministry of Communications on coal pier construction at Zhicheng in Hubei Province and at Nantong in Jiangsu Province in order to solve the coal external shipping problem for western Henan, southeastern Shanxi, Shaanxi, and Liupanshui by fully utilizing the surplus capacity of the Jiaozhi and Zhiliu railroads and barge transportation on the Chang Jiang. The ministry has also suggested that responsible departments make use of the Jing Hang Canal and the Huai He, Han Shui, and Xi Jiang river systems. (2) Accelerate the modification of storage, and loading and unloading in mines, by renewal and expansion, and make them compatible with coal production capacity. (3) Actively develop coal slurry pipelines, a new technology that has matured on the international scene. We should absorb the foreign experience and investigate it with domestic resources so that it may play a role at key locations at the key time. We should also gradually move toward developing a comprehensive network of railroads, waterways, and pipelines. (4) Develop heavy locomotives, high-tonnage trains, and

9698
CSO: 4013/48

DEVELOPMENT OF NEW OPEN-PIT MINES COULD SOLVE NATION'S ENERGY SHORTAGE BY 1990's

Beijing SHIJIE MEITAN JISHU [WORLD COAL TECHNOLOGY] in Chinese, No 2, Feb 83, pp 6-8]

[Article by Wu Zhixiang [0702 0037 7534], adviser to the Planning Department, Ministry of Coal Industry: "The Five Large Open-Pit Coal Mines in the Modernization of China's Coal Industry"]

[Text] The documents of the 12th Party Congress point out that the present shortage in energy and transportation is an important factor limiting our nation's economic development. To guarantee sustained growth of the national economy, we must intensify the development of energy, and at the same time we must greatly bolster the buildup of communications and transportation. The conference resolved to push the development of energy and build up communications and transportation by the end of this century, a decision important to the development of our national economy.

Although the exploration for and exploitation of petroleum and natural gas will continue, as will the construction of hydro-electric power stations, coal will play a more important role for the present and in the future. The amount of coal constitutes 72 percent of our nation's energy consumption, and will remain at about 70 percent for some time to come.

China's coal resources are abundant. Of the known reserves of over 600 billion tons found in geological prospecting, most are concentrated in Shanxi and the Nei Monggol Autonomous Region. The coal is suited for various methods of mining, including horizontal cavern mining, vertical shaft mining, inclined shaft mining and open-pit mining. The known reserves in the five open pit mines in Shanxi Province and the Nei Monggol Autonomous Region and nearby regions amount to more than 60 billion tons. These five large open-pit mines that are about to be developed have thick coal seams, the reserves are concentrated, the upper covering layer is thinner, the stripping ratio is smaller, and they are suited to the use of modern equipment for large-scale open-pit mine construction and production. Large thermal power plants can be built nearby to form a comprehensive, large-scale fuel and power base centered around coal and electricity. In the planning and construction of the five large open-pit mines, modern equipment used in the world today has been used, such as the bucket-wheel excavator and rubber belt conveyor which are used in continuous extraction, and heavy electric motors or hydraulic tunnellers-heavy dump trucks for discontinuous extraction, and the backhoe technique.

Such machinery can produce high output, has high efficiency, and is low in cost, safe and reliable. The construction period is short, coal extraction is quick, pit props are not used and better economic results can be realized. Foreign nations already have a lot of experience in using such equipment. China is also gradually carrying out research and development of such modern equipment to create favorable conditions for the development and construction of large open-pit coal mines. Therefore, building these mines as quickly as possible has become an urgent task in China's coal buildup.

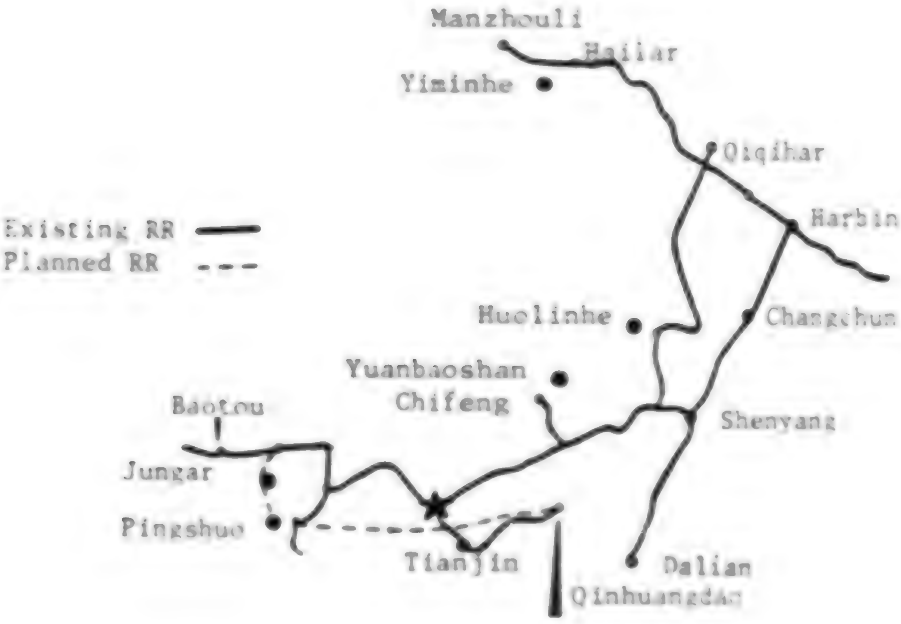
The known reserves of these five large open-pit coal mines amount to more than 60 billion tons, including more than 9.8 billion tons of precisely measured reserves. The preliminary plans call for an annual output of 200 million tons of raw coal. In the steps of construction, development will progress in phases and groups. Generally speaking, preparations prior to construction will be carried out from the present to 1985, including comparison of plans, feasibility studies, construction of railroads, power supply, and water supply management and training of technical personnel. At the same time, a part of the open-pit mines will be excavated. This period will be the initial period of building the open-pit mines. The period from 1985 to 1990 will be the period of overall large-scale development and construction. Another group of open-pit mines will be excavated before 1995 so that by the end of this century the output of China's open-pit mines may be over 200 million tons. By that time, besides our output from coal shafts, the production of open-pit mines will constitute a very large portion and play an important role in solving our energy shortage.

To expand resources for developing open-pit coal mines, we plan to begin in 1983 to concentrate 20 prospecting teams to prospect for a precise reserve of 15 to 20 billion tons as reserve resources for developing new open-pit mines.

The five large open-pit mines are briefly described in the following, their geographical positions are shown on the map.

1. The Yuanbaoshan Open-Pit Coal Mine in the Nei Monggol Autonomous Region

This mine is situated in Chifeng City, Zhaowuda League, in the eastern part of the Nei Monggol Autonomous Region. It is a new area of the Pingzhuang Mining Bureau currently in production. A railroad has been built. The precise reserve is 540 million tons. Plans call for an annual output of 8 million tons of raw coal. The coal seams are in seven groups with a total thickness of 74 meters, running to more than 100 meters in spots. At three places, the thickness of the main exploitable layers is about 47 meters. The coal seams are inclined 3 to 14 degrees. The coal is lignite. The ash content of the raw coal is 13.3 percent, the moisture content 14.7 percent, and the sulfur content less than 1 percent. The thermal value is 3,200 kilocalories/kilogram, the average stripping-to-extraction ratio is 3.54 cubic meters/ton. A 600,000-kilowatt power plant has already been built at the mouth of the pit near the Yuanbaoshan open-pit coal mine. There are plans to expand it and to link it with the large nearby Northwest Grid. The mining method uses bucket-wheel tunnellers and belt conveyors for continuous mining. Preparatory work and economic and technical comparison of the development plans are being carried out. After completion of the open-pit coal mine, the coal produced will be sent directly to the nearby power plant. The water drained from the pit can provide one-third of the water for cooling the power plant.



Geographical location of the five large open-pit mines

II. The Huolinhe Open-Pit Coal Mine in Nei Monggol

The Huolinhe coal field is located inside Zhalute Banner, Zhelimu League, in the eastern part of the Nei Monggol Autonomous Region. The area of this coal field is large, the reserves are abundant, and at present, the known reserves amount to about 13.1 billion tons. The plan for the initial stage calls for building the first open-pit mine at Shaerhure which has a precise surveyed reserve of 2.58 billion tons. The total mining capacity will be [illegible],000,000 tons. Construction will first be carried out for an annual output of 20,000,000 tons. It is expected tha. it can produce 3 million tons of coal in 1985. A special railroad line 400 kilometers long from the mine to Dongliao has already been built. The coal is lignite. There are 9 layers of coal seams of a total thickness of about 81 meters that are exploitable. There are three main exploitable layers with total thickness of about 32 meters. The average stripping-to-mining ratio is 3.44 to 4.11 cubic meters/ton. The coal is lignite, the sulfur content is 0.7 percent, the thermal value is 4,100 kilocalories/kilogram. The shallow part of the open-pit mine is suitable for using the bucket-wheel excavator. The middle and the deep parts are suitable for using the large electrical or hydraulic single bucket excavator-large automatic unloading dump trucks. The feasibility study on which method of mining should be used is currently being carried out, as are technical and economic comparisons. The lignite produced at the mine can supply the Dongliao Power Plant (400,000 kilowatts) which is about to begin production. Also, because the underground water sources along the Huolinhe to Tongliao Railroad are abundant, we plan to build a 4-to 5- million-kilowatt power station. Therefore, the Huolinhe open-pit coal mine and the railroad will form a large fuel and electric power base. The coal produced will supply the Nei Monggol Autonomous Region. The electric power generated by the coal will be transmitted via ultrahigh voltage powerlines feeding into the large Northeast Power Grid. The project will be a stong support in fuel and electric power for the strong industrial region in the Northeast.

III. Yiminhe Open-Pit Coal Mine in the Nei Monggol Autonomous Region

This mine is situated in the Hulun Boir League in the eastern part of the Nei Monggol Autonomous Region 85 kilometers south of Hailar City on the Binzhou Railroad. A railroad has now been built to the mining area. The coal field has a known reserve of 5 billion tons with 2.285 billion tons of precisely known reserves. The annual output of raw coal of the open-pit mine will be 20, 00,000 tons. The mine is divided into several zones. Construction of the first zone has already begun. There are 17 coal seams with a total thickness of 76 meters. At individual places, the thickness surpasses 100 meters. There are two main exploitable seams with a total thickness of 50 to 60 meters. The average stripping to mining ratio is 2.5 cubic meters/ton. The first zone will be mined by single bucket excavators-large automatic unloading dump trucks. Later, bucket-wheel excavators will be used. A large power plant will be built at the mouth of the pit and another in Hailar City to transmit electricity to the large Northeast Power Grid.

The Yiminhe coal field is widely dispersed. At present, there are also such coal fields as Baorexile north of Hailar City. They are close to the railroad, the deposits are shallow, and the future reserves are large. The known reserves amount to more than 10 billion tons. Prospecting is also being carried out in other regions. Because deposits are shallow and the mining conditions are good, these regions are all suitable for open-pit mining. Prospecting of other regions is also being carried out.

IV. Pingshuo Open-Pit Coal Mine in Shanxi Province

Located in Pinglu and Shuo Xian in Shanxi Province, the open-pit coal mine is only 20 kilometers from the Bei-Tong-Pu Railroad. The reserves of the Pingshuo coal field are rich. The known reserves amount to 12.7 billion tons. Of this, 8.4 billion tons are found west of Maguanhe. Ten to 12 groups of open-pit mines can be planned for mining. We have selected the Antaibao open-pit coal mine. The precisely surveyed reserve is 1.36 billion tons. It will be developed as the first open-pit coal mine. It has 8 coal seams that are 38 meters thick. The main exploitable seams are 30 meters thick. This open-pit mine has signed a contract with Island Creek of the United States for a joint venture to produce 15,000,000 tons of coal a year, and to build a large coal washing plant. At present, the feasibility study phase is about to be concluded. The coal is mainly gas coal, there is a small amount of fat coal, the thermal value is high, generally about 7,000 kilocalories/kilogram, and it is a better power coal. After the coal from the open-pit mine is washed, the coal concentrate can be exported. Medium coal, mud coal, and some raw coal will be supplied to the large Shentou Power Plant nearby.

While developing the Pingshuo open-pit mine, we are prepared to build trunk railroad line from Pingshuo to Qinhuangdao harbor for direct shipment of coal to step up the export of coal from Shanxi Province.

At the Pingshuo open-pit mine, there is also a layer of superior quality refractory clay about 15 meters thick. It will be extracted simultaneously with the stripping of the coal seam of the open-pit mine. There is also superior quality limestone nearby, therefore besides exporting coal, refractory materials, pottery and porcelain and cement industries can also be developed locally.

V. The Jungar Open-Pit Coal Mine in Nei Monggol

The Jungar coal field is situated 150 kilometers south of Huhehot City in the Nei Monggol Autonomous Region. It lies along the Huang He and is spread over a large area. The present known reserves amount to 11.3 billion tons. We have selected the two open-pit mines of Heidaigou and Yaogou first for development. The precisely surveyed reserves amount to 3 billion tons. The initial annual output is 15,000,000 tons and the total output is 50,000,000 to 60,000,000 tons. The coal of the entire region is flame coal. It is a very good power coal. There are 9 exploitable coal seams with a total thickness of 34 meters. Of these, two main exploitable seams have a thickness of 31 meters. We plan to build a large thermal power plant nearby to provide electricity to Hohhot and Baotou and to transmit electricity via Shanxi to Beijing and to link up with the Beijing-Tangshan-Tianjin Power Grid. At the same time, we are consi[illegible]g building a special railroad line for transporting coal to the Pingshuo open-pit mine in Shanxi and then ship the coal to Qinhuangdao Harbor. Future plans call for cooperation with foreign concerns to study the use of pipelines to transport coal to Qinhuangdao Harbor.

As the five large open-pit mines are developed and constructed, electric power and the amount of railroad transport will simultaneously and continuously develop. The amount of coal shipped and the amount of electricity transmitted to North China, the Northeast, Eastern China, and the South Central region will increase yearly. Thus, by the 1990's, China's energy shortage will be basically solved. Of the five open-pit coal mines described above, three are open lignite pits. We need to study gasification, liquefaction and compression and forming to manufacture coal bricks so as to create a new energy structure and improve thermal efficiency. Large power plants have all been built near these five open-pit mines. In future business management, we should reform the system and gradually progress towards a joint management of coal and electric power.

While developing the five large open-pit mines mentioned above, we are mainly relying on our own strength to build them. At the same time, we will also cooperate with foreign firms under the principle of equality and mutual benefit. We welcome friendly firms to sign joint development ventures or provide consultation services. We are confident and determined to accelerate the construction of the five large open-pit mines and to make new contributions to our nation's energy industry.

9296
CSO: 4013/156

COAL

WAYS TO ACCELERATE GROWTH OF YUNNAN COAL INDUSTRY SUGGESTED

Kunming YUNNAN RIBAO in Chinese 20 Jan 83 p 2

[Article by He Peilin [0149 3099 2651] of the Yunnan Coal Mining Bureau: "Some Suggestions on Accelerating Yunnan's Coal Industry"]

[Text] Coal is of strategic importance in achieving our great goals. The development of the coal industry by all possible means is an urgent task.

The development of Yunnan's coal industry has been very rapid. Yunnan's annual coal production today is 50 times that shortly after liberation, but it still cannot satisfy the demands of agricultural and industrial production. The shortage of coal in recent years has been more than 1 million tons a year and Yunnan has had to seek relief from other provinces. We must therefore give the development of the coal industry serious thought and consideration on a practical basis. We now make the following suggestions:

1. Development of New Mines

The annual production of raw coal in Yunnan in recent years has been around 12 million tons. Only a little more than half of the coal produced is available for provincial unified distribution, the rest being consumed at the prefecture and county level or left undelivered due to inadequate transportation and other reasons. More than two-thirds of the coal is consumed by the power industry and civilian use in the central and southern regions of Yunnan where industry is concentrated. In the past, the shortage was generally made up by limited production increases or by increasing the purchase of coal by commune and brigade mines; in the meantime, we had to hope for heavy rains to reduce coal consumption by the power industry. These are unrealistic and unreliable methods. When we look at the production capacity of state-operated coal mines under the jurisdiction of the provincial coal mining bureau and the provincial labor reform bureau, the long-term disruptive "leftist" influence of the past caused the majority of coal mines to fall below their verified production capacity while some mines were nearly worked to exhaustion. According to the short-term plans of these coal mines, it will be 1985 at the earliest before verified productivity can be reached by speeding up equipment installation and by developing the potential of old mines, discounting shortages in funds and material. Even so, this still will not satisfy the needs of industrially concentrated areas. To solve the coal shortage problem, we must devote major effort to the capital construction of coal mines, the development of new mining zones and the increase in productivity while striving to conserve energy. Based on the surveyed and verified coal reserves from previous geological work, we must strive to resume construction of the Tianba coal mines, complete the Housuo mine, build new mines in the Enhong field and work on the new construction of the Xundian open-pit mine. Only then can the productivity of the province's state-operated coal mines reach a level twice the current verified productivity by the year 2000. Together with the production of state-operated coal mines at the county level and the numerous commune and brigade mining enterprises in the province, the production of coal will be near the 30-million-ton level.

2. The Leading Role of State-Operated Economy

Yunnan has a rich reserve of coal and a large number of collectively owned commune and brigade mines. These coal mines are widely distributed, they produce a large quantity of coal with modest investment, short construction time, and low cost. They play an important role in providing coal to various regions and departments in the national economy and we should at no time neglect this important force on the industrial front of coal production. However, the commune and brigade mines also suffer from a number of shortcomings: most of these mines are producing "outcrop" coal mined manually, without the benefit of formal survey and design and lack the necessary mechanical equipment. Some are also limited by transportation, water and electricity, and their production is highly seasonal. As a result, they suffer from frequent location change, a high loss of resources, lack of safety measures, intensive labor effort and instability in production. While we build up and strengthen the state-operated coal mines and develop the leading role of a state-operated economy, we should also improve the commune and brigade mines. For those commune- and brigade-operated coal mines that are rich in reserves, convenient in location, safe to operate and whose production value does not affect the production of state-operated mining regions, we should strive for technological improvements, or organize joint operation so that they may gradually achieve a regular mode of mining and maintain better production stability.

3. The Production and Supply System

Coal is a bulk commodity unsuitable for storage in large quantity. Once it is produced it requires timely transportation. Production, transportation, and supply form a tightly knit, inseparable system. Coal is also a commodity normally delivered to the user directly from the producer. Whenever possible, the direct delivery mode is preferred and any intermediate steps should be kept at a minimum. Because of these features, the management of coal sales should be a coordinated system involving production, transportation and sales in order to guarantee sustained production and meet consumer demand. Coal is a fuel as well as a raw material and a production material as well as a consumer material. Coal must be under a centralized management by the state, and planning, distribution, and pricing must all be unified. The system should primarily be based on planned adjustments and gradually achieve a production-consumption contract system. The supply of coal should be based on the user's consumption level and the distribution should be systematic and based on quantity, quality (grade), variety and location. By making sufficient use of the resources, reducing transportation costs, simplifying the supply procedures, and improving economic efficiency, we can gradually establish economic management by economic means.

9698
CSO: 4013/151

FOREIGN COOPERATION PLANNED FOR HAINAN COAL MINE

HK231504 Beijing ZHONGGUO XINWEN SHE in Chinese 1409 GMT 23 Mar 83

[Article: "The Xinan Company Will Cooperate With Foreign Companies in Developing the Hainan Changpo Opencut Coal Mine"]

[Text] Beijing, 23 Mar (ZHONGGUO XINWEN SHE)--Ling Peihong, general engineer of China's Xinan Joint Energy Development Company, today disclosed at a discussion meeting on coal mine investment and markets in China that his company is planning to cooperate with foreign companies in developing the Changpo opencut coal mine on Hainan Island.

This coal field has an area of 42 square kilometers. It is located in the northeast part of the island, 35 kilometers from Yangpu Harbor to the west and 175 kilometers from Haikou City to the north. Therefore, it has convenient transportation conditions. The reserve of brown coal in the Changpo coal mine amounts to 300 million tons, with a calorific value of 2,500 large calories. The area also contains about 100 million tons of peat. According to the tentative plan, the coal field will be exploited as an opencut mine with a yearly output of 1-2 million tons of coal.

It has been learned that some foreign companies and businessmen have shown interest in the development plan and have contacted the Xinan Company.

The Xinan Company is also planning to cooperate with foreign companies in developing the Zhaotong and Xianfeng opencut coal mines in Yunnan Province. These two mines, plus the Changpo mine in Hainan, will produce 35 million tons of coal a year.

CSO: 4013/177

COAL

COMBUSTION CHARACTERISTICS OF CHINESE STEAM COAL STUDIED

Beijing MEITAN KEXUE JISHU [COAL SCIENCE AND TECHNOLOGY] No 10, 25 Oct 82 pp 24-27

[Article by Lin Hao [2651 3493], Wang Fang [3769 2455] and Yan Dezhong [7051 1795 1813] of the Thermo Engineering Department, Qinghua University: "Combustion Characteristics of Chinese Steam Coal"]

[Text] China has rich coal reserves, the variety is complete and the distribution is wide and yet relatively concentrated. Two thirds of the coal reserve is in northern China. Steam coal accounts for 60 percent of the total coal reserve and one third of the steam coal are weak brown coal and anthracite. Because of the lack of rational allocation and utilization the efficiency is very low in coal usage. Insufficient analysis and understanding of the combustion characteristics of coal also contributed to this result.

Different combustion equipments have different requirements on coal; for example, a link belt furnace requires a certain grain size and moisture content and that the coal it burns does not form coke. Burning in this kind of furnace relies mainly on heat radiation inside the furnace and convection of the hot smoke and gas; thus, the conductivity and the specific heat of the coal are important for good combustion. Laboratory measurement results cannot possibly meet the combustion requirements of production facilities completely. If the case of ignition, speed of combustion and the possiblity of total burning can be assessed, then, together with actual combustion results, it is possible to come up with an accurate estimate of the combustion characteristics.

Coal research in the last two decades indicated that after the coal is ignited, whether the combustion is in layer or in suspension, the combustion is carbon continuous or parallel combustion of volatile matters. Under normal flame temperatures, the reaction ability of carbon is no longer a major factor. The deciding factors are the oxidation and reaction at the coal surface or at the surface of the pores. Therefore, diffusion of gas flow boundary layer, diffusion into the pores, oxidation absorption at the surface and decomposition and absorption of the reaction products should all be considered.

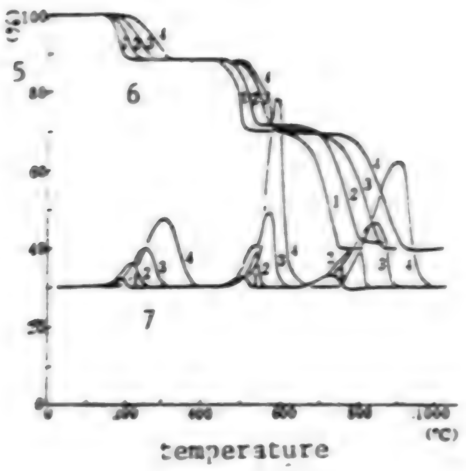
I. Measurement of Combustion Characteristics

The process of releasing volatile matter by coal upon heating involves the release of water, gases adhered in the pores and the light components of the dissociated organic matters. At 300~500°C, methane and its homologues are released; at 500~750°C, the release gas is relatively hydrogen rich. Hence, there are scientific basis for evaluating the combustion characteristics from the content of volatile matters. When the ash content is high, using the combustible volatile matter content V^r often leads to large errors in evaluating the combustion characteristics of coal. This is because that ash is not a material of fixed composition and part of its constituents may evaporate upon heating. In addition, the variation and distribution of ash composition also affect the combustion of the combustibles in coal. When an oxidizing agent is added to coal and the coal is heated to produce deflagration or rapid temperature rise, the temperature is known as the ignition point. A measure of the ignition point of coal is an indication of the ease or difficulty for ignition. If coal is ignited by some method and then, by varying some parameter, the limit of flame instability may be determined, this temperature is known as the extinction point. Results obtained by these methods can all reflect to a certain degree the ease of ignition and the stability of combustion in actual burning processes.

One method is to ingite the coal powder, maintain a high temperature and then observe the combustion under an oxidizing atmosphere. The heating rate in this method can approach the acutal situation in a real burner device. Measurements clearly show the release and subsequent ignition of the volatile matters, the bright flame around the coal grain and part of the thread-like ashes around the coal grain. And sometimes gases are ejected from small pores on the grain. This method of study is quite helpful in understanding the ignition and combustion mechanism of coal and it is also useful for observing the differences for different varieties of coal during the combustion process. But this method requires sophisticated equipments and advanced measurement techniques and cannot be used by ordinary production units.

The thermal absorption and emission of coal under heating can also be studied with a differential thermal analyzer. Using a reference material subjected to identical heating conditions, the temperature difference of the coal sample and the reference material may be used in obtaining the combustion characteristics of coal. The reference material used should neither absorb heat nor emit heat under such heating conditions and its grain size and thermal conductivity should also be similar to the coal sample to be tested. Figure 1 shows the relationship between heating rate and weight loss and weight loss rate and Figure 2 shows the corresponding thermal differential curves.

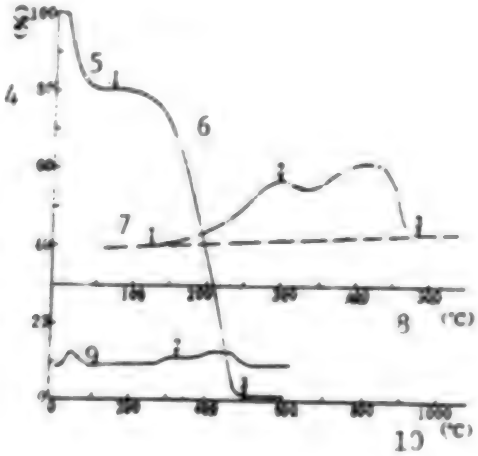
Figure 1. Relationship between heating rate and weight loss and weight loss rate



Key:

1. 10°C/min
2. 20°C/min
3. 50°C/min
4. 100°C/min
5. Residual weight/original weight (%)
6. Weight loss
7. Weight loss rate

Figure 2. Changes of coal upon heating



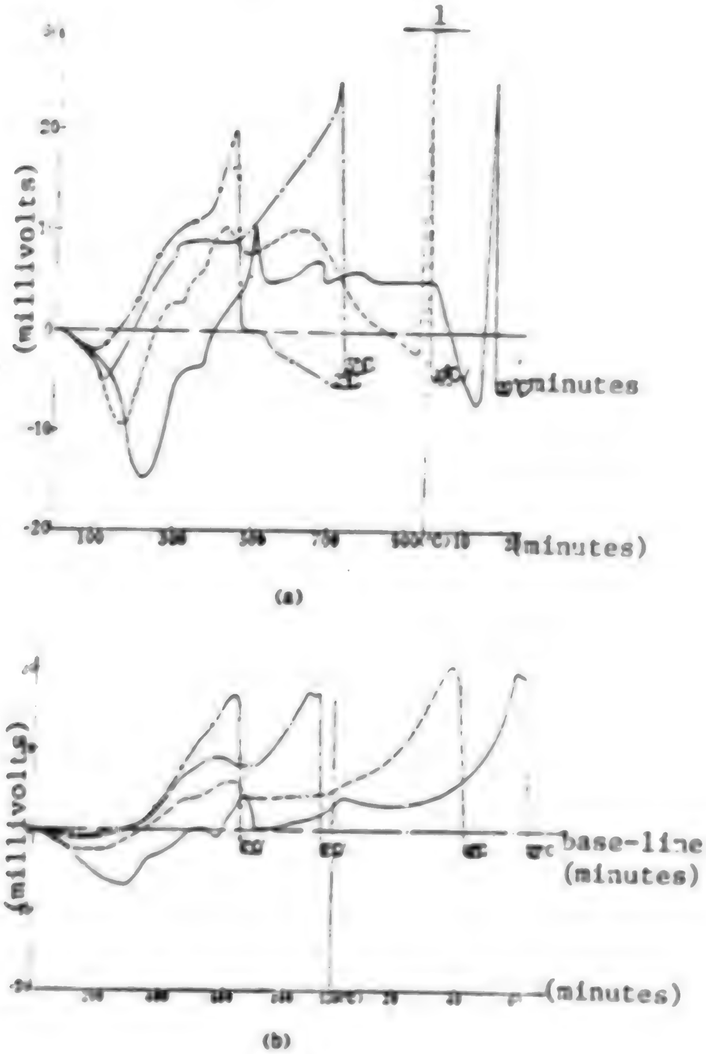
Key:

1. Beginning of thermal dissociation
2. Peak of volatile release
3. End of combustion
4. Residual weight/original weight
5. Dehydration
6. Weight loss curve
7. Differential curve
8. Differential temperature
9. Weight loss rate
10. Weight loss temperature

II. Measurement Conditions and Results

Using a Chinese-made differential thermal balance, and comparing the results obtained on similar foreign-made apparatus, we found that the Chinese apparatus performed satisfactorily. The zero point of the recorder was found to drift somewhat during measurements and the drift increased for higher heating rates. As a comprise of zero drift and experiment time, we decided to use a heating rate of 10°C/min and, when necessary, results at other heating rates were used as references. We made detailed measurements of the weight loss under various heating rates for anthracite and brown coal. As can bee seen from Figure 3 and 4, the 10°C/min heating rate satisfied the needs to compare different coal specimens. Since the maximum allowable temperature of the apparatus was 1000°C and considerable amount of coal sample still remained after reaching 1000°C, we stopped the heating at 950°C and maintained at that constant temperature until all the sample was burned.

Figure 3. Thermal differential of coal at different heating rates



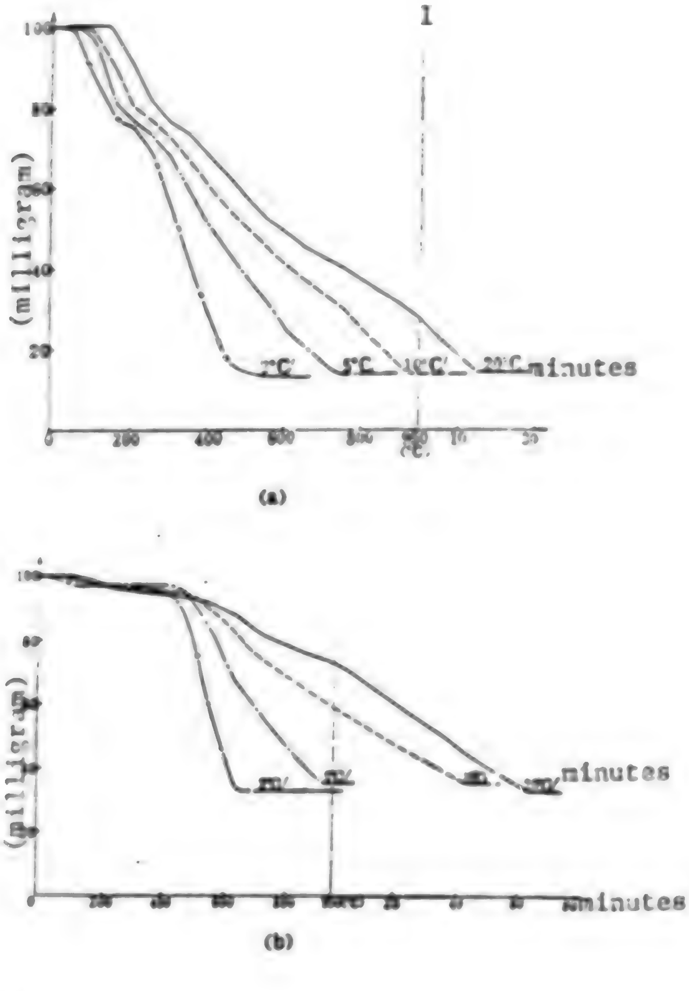
(a)

(b)

Key:
- (a) Brown coal
- (b) Anthracite coal
- 1. Temperature-Time boundary (Buzhaoba brown coal)
- 2. Temperature-Time boundary (Jinzhushan raw coal)

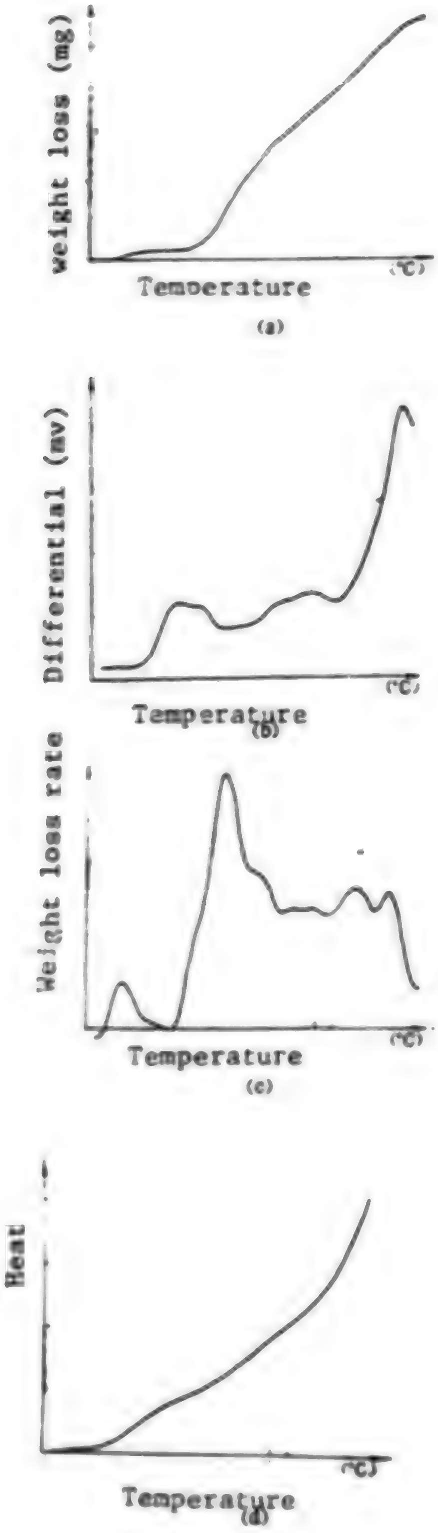
Using the method just described, we selected 40 major steam coals in China and performed measurements on the same differential thermal balance. In order to avoid equipment or sample errors, we made at least three measurements for each coal variety and then processed the weight loss curves and the differential curves with model functions and obtained the weight loss rates and the heat release curves, see Figure 5.

Figure 4. Weight loss of coal under different heating rates



Key:
- (a) Brown coal
- (b) Anthracite
- 1. Temperature-Time boundary (Buzhaoba brown coal)
- 2. Temperature-Time boundary (Jinzhushan raw coal)

Figure 5. Weight loss rate and heat release curve of Bucan coal



Key:
- (a) Weight loss
- (b) Differential curve
- (c) Rate of weight loss
- (d) Heat curve
- 1. Constant temperature above this

As can be seen from the weight loss curve (Figure 5(a)), there is almost no heat absorption process since the water content of the coal is very low. Above 100°C, the weight begins to drop and the rate of weight loss increases rapidly (Figure 5(c)). Above 200°C the rate of weight loss decreased because of the release of volatile gases and a peak is formed between 250°C and 500°C (see Figure 5(b)). Figure 5(d) also shows the increase in heat. A second peak in the weight loss rate appears near 500°C and after that the weight loss rate basically remains unchanged. These results showed the combustion of the released volatile matter and the burning and exhaustion of the coke. Based on the actual burning of Chinese coal and measurement results of the coal varieties described above, the combustion characteristics may be different even though the content of combustibles is approximately equal. Therefore we propose three parameters to describe the combustion characteristics of coal: the ignition index, combustion index and complete burning index. We have selected 13 representative coal varieties out of the 40 coal samples tested for date processing and computation. The table below lists industrial analysis results and the three indices. In the table, the ignition index is equal to the heat released at 500°C divided by 1000, the more heat released, the easier to ignite. Combustion index is equal to (time to burn 80 percent of combustibles-time to burn 50 percent of combustibles)/30, a low combustion index indicates that the coal is easy to burn. Complete burning index is equal to 1000 divided by the time to burn the coal completely, a small value of complete burning index would mean that it takes a long time to burn completely. Looking at the index for complete burning, one realizes that certain anthracites are difficult to burn completely because they release their major heat content relatively late and the burning does not develop well. In terms of ignition indices, there are pronounced differences. For example, the Lujiadi coal has a low content of combustible volatile matter but its ignition index is good; as a result, its ignition characteristics are good, as was confirmed by actual operation in power plants. The ignition properties of Daihe coal and Jiaozuo coal are affected by the ash comtent and Huainan coal is ignition-retarded because of the excessive water content. Therefore, although the weight loss and thermal differential obtained in slow heating will differ from the results in actual production facilities, but the evaluation of combustion characteristcs appears quite reasonable as compared to results based on industrial analysis such as combustible volatile content.

III. Discussion

1. It is feasible to compare the combustion characteristics of one kind of coal to those of other kinds of coal in a given combustion device. The procedure is to measure the weight loss curve and the differential curve under a given heating rate, then compute the rate of weight loss and heat release and deduce the indices of ignition, combustion and complete burning.

2. The heating rate in actual combustion devices is several orders of magnitudes greater than the heating rate used in the present experimental apparatus and the final temperatures are also different. These differences

Table 1. Industrial analysis and combustion characteristics of Chinese steam coal (in order of combustible volatile matter content)

Origin	V^r (%)	A^f (%)	W^f (%)	O^f DW kcal/kg	Ignition Index N1	Combustion Index N2	Complete Burning Index N3
Jiafu	4.57	33.50	0.90	4814	0.167	2.20	3.40
Lujiadi	4.91	22.69	2.57	5366	0.511	2.48	3.05
Shaowu	7.99	40.49	3.30	6015	0.573	2.02	3.88
Jiaozuo	10.34	33.35	1.96	5257	0.510	2.27	3.90
Xiyu	12.16	17.40	1.30	6784	1.151	2.43	3.47
Yangquan	13.32	16.82	1.01	6818	1.125	2.47	3.37
Bucun	19.24	38.22	1.34	5621	1.041	2.12	3.94
Daihe	21.46	38.83	1.21	5438	0.460	2.18	3.98
Laiwu	39.65	32.37	1.10	5275	1.305	2.32	4.16
Huainan	42.80	25.90	3.40	5543	1.366	2.42	3.94
Shiheng	44.05	23.43	1.45	5968	1.140	2.28	3.98
Yima	44.93	34.17	8.68	3860	1.346	1.97	4.98
Huangxian	56.99	9.11	4.55	4405	2.246	2.[illegible]7	4.73

will inevitably affect the composition and the release of combustibles and thereby the combustion characteristics of coal.

3. In the present experimental setup, the reference material and the sample are situated in the same electric furnace. The heat absorption and emission of the sample affect the temperature of the reference material and cause errors in the measured thermal differential. The flow of gas also affects the measurement of weight loss. Both experimental apparatus and measurement technique may be improved.

References

1. Progress Report--Ignitibility of Solid Fuels and Burning Rates of Fixed Carbon, ASME 56-FU-5.

2. Fuel Evaluation Using Differential Thermal Techniques, Foster Wheeler Development Corp.

3. Burning Profiles of Solid Fuel, Power Engn. 1969, Jan.

4. Further Development of the Burning Profile, Journal of Power, Trans. ASME, 1973, April.

9698
CSO: 4013/48

COAL

METHODS OF INCREASING COAL RECOVERY RATE DISCUSSED

Beijing SHIJIE MEITAN JISHU [WORLD COAL TECHNOLOGY] in Chinese No 12, Dec 82 pp 2-4

[Article by Coal Mining Engineer Rui Sush[illegible] [5360 4790 3932], director of Institute of Scientific and Technical Information, Ministry of the Coal Industry: "Ways of Increasing Resource Recovery Rates in Coal Mines"; paper presented at first China-U.S. Energy, Resources and Environment Conference"]

[Text] Increasing the resource recovery rate in coal mines plays a major role in improving the technical and economic benefits produced by coal mines.

In the 1950's, by means of several measures which improved coal extraction techniques, we considerably increased our coal mine recovery rate. But subsequently the recovery rate was unstable, and currently it is at a rather low level. Recovery rates in most coal mines are below the state standard and below historic highs; it is generally about 50 percent in ordinary coal extraction, about 60 percent in horizontal-seam coal extraction, and about 70 percent in mining district extraction.

The low recovery rate has had serious consequences. In 1981 the Ministry of the Coal Industry made increasing the recovery rates one of its key readjustment activities, and it is currently taking steps in five areas to increase recovery rates.

1. Reforming Low-Recovery-Rate Extraction Methods

In the initial period after Liberation, our country used mostly old, outmoded coal extraction methods, and recovery rates were about 30 percent. In 1954 the Ministry of the Fuels Industry published a "Decision on Improving Coal Extraction Methods," which reformed the old methods and introduced the longwall method on a large scale, producing a large increase in recovery rates. In 1956 the mining district recovery rate had exceeded 80 percent. Currently our country is essentially still using the longwall method (accounting for about 90 percent of all coal mines) but during the 10 catastrophic years, production management was thrown into chaos, and some mines went back to using old, low-recovery-rate methods. For example, some mining offices were largely using the room and pillar method, and in 1976-1979 the average mining district recovery rate was only 35 percent. Because of these and certain other factors, the 1981 coal recovery rate in coal mines under our administration was about 7 percent below the historic highs. To increase recovery rates we must start by reforming low-recovery-rate methods.

Our country has a large percentage of gently-sloping thick or very thick coal seams (see Table 1), and it is very easy to lose coal in working them; we are now using the multiple, horizon sloping, longwall method to mine these seams, with excellent results. In coal seams 6 to 10 meters thick, we generally use the method of downward caving with manmade ceilings in sloping horizons; we have accumulated a great deal of experience with it. In the Yaojie mining district this method was successfully used in working 12 to 15 horizons with a total thickness of 25 to 30 meters. The Fushun mining office used the upward rock and sand fill method in sloping seams to work 35 separate horizons with a total worked thickness of 80 meters. The recovery rate with this technique is generally above 70 percent, and in most cases reaches the national standard of 75 percent.

Table 1.

Item		Percentage of output
Thickness of coal seams (m)	<1.3	12.74
	1.3∼3.5	43.32
	>3.5	43.94
Slope of coal seams (m)	0∼12	45.69
	12∼25	36.54
	25∼45	12.17
	>45	5.60

In recent years, some mining districts have used the sloping longwall method in place of the strike longwall method in seams with a slope of 12° or less and have increased recovery rates by 5 to 10 percent. According to statistics for 1981, the sloping longwall method has already been employed in 151 workfaces. About half of our country's coal output comes from coal seams with a slope of 12° or less, so that this method of working them can be widely used. In 1980 it was already included among the "50 techniques for dissemination in the coal industry."

In the Datong and other coal districts, some coal seams have very strong roof rock which is hard to cave. Originally the "knife and pillar" method was used, which not only give low recovery rates in the horizon being worked, but also seriously harmed recovery rates in the coal seams directly below. In recent years, longwall mining with artificial induced caving has been tested; it has been essentially successful in cases where the roof rock consists of hard-to-cave sandstone and conglomerate. Preparations are now underway for expanded experimentation in coal seams where the roof rock is very hard-to-cave thick conglomerate; in addition to forced injection of water into the roof rock to soften it and explosive breaking of the roof rock, high-pressure supports, each of which has a working strength of 720 tons, will be used.

2. Changing Tunnel Protection Methods and Making Broader Use of Methods Which Do Not Use Coal Pillars

Using coal pillars to protect tunnels wastes large amounts of coal. Coal lost in the protective pillars that protect the tunnel at the two ends of the work face alone accounts for 40 percent of total coal losses.

In order to expand the use of tunnel protection without coal pillars, in 1977-1981 the Ministry of the Coal Industry held three technical conferences and issued some "Provisional Regulations on Promoting the Use of Coal Extraction Without Coal Pillars." According to incomplete statistics, by the end of 1981 15,000 meters of quehang [2228 1574] tunnels and 100,000 meters of liuhang [3966 1574] tunnels had been driven, and the additional coal extracted amounted to about 5.5 million tons.

Protection of tunnels without coal pillars generally can increase recovery rates by 10 to 15 percent. It is used in gently sloping and sloping seams whose roof rock can be caved in and in low-gas mines, and has already yielded excellent technical and economic results. It is currently being tested under other conditions in order to expand its range of applications.

3. Development of Equipment for Working Thin Seams and Thick Seams in Order To Decrease Coal Losses

Some important reasons for the low coal recovery rate are loss of thin coal seams and seams interbedded with gangue, and loss of some of the seam thickness in thick seams. According to 1979 statistics for 65 offices and mines, thin seams accounted for 21.5 percent of all extractable reserves, but for only 16 percent of total coal output in that year. In some mines, combine extraction with high rates of advance is used for thick seams, while explosive extraction is used for thin seams and the rate of advance is slow, so that large amounts are lost. Our country has large amounts of coal seams 3.5 to 4.5 meters thick; the combine extraction method generally cuts only 2.5 to 2.8 meters, leaving the remainder behind, so that the loss is serious. In 1974-1979, a certain mine used the combines on a total of 14 work faces with a total thickness of 49.6 meters; the extracted thickness was 35 meters, resulting in a loss of 14.6 meters. One work face was 5.2 meters thick and only 2.4 to 2.7 meters was cut, so that the loss amounted to about half.

One of the main reasons for this situation is the lack of equipment with a suitable cutting height. Of the equipment used t work thin seams in this country, coal plows have insufficient power, while the coal cutters are quite inadequate. Our country produces combines with a cutting height of 1.3 to 3 meters, but we lack needed equipment with cutting heights of 0.8 to 1.3 meters and 3 to 4.5 meters. At present the research units and factories are developing the necessary equipment. It is expected that this year and the next 2 years several hydraulic supports and 300 kW coal cutting machines with cutting heights of 3.5 to 4.5 meters will be developed and tested in the mines. Several cutters with minimum heights of 0.8 and 1 meter and powers of 100 kW and 150 kW are being tested or undergoing expanded trials; in addition, development of an 0.6-meter coal cutter and a 2 x 75 kW coal plow has begun. Combines for thin seams should also be developed.

4. Investigation and Development of Working Methods for Special Conditions, Coal Cutting in Seams Threatened by Karst Water and Under Buildings, Water Bodies and Railways

In our country, reserves of more than 7 billion tons are threatened by karst water, making extraction difficult. These coal mines are generally at the lowest levels of the North China coal fields and are only 25 to 95 meters away from water-containing limestome floor rock. When they are extracted, the water in the floor rock (the water pressure acting on the coal seam usually is 15 to 25 kg/cm^3) frequently bursts into the coal mine, sometimes at a flow rate of 240 m^3/sec, which gravely threatens production. According to statistics on the Fengfeng Mining District and 20 others, the amount of coal not extracted because of water problems is a fifth of the total in these districts, while it amounts to fully half in some of the offices.

We have studied various measures to solve this problem. In recent years we have concentrated on prevention and rational dredging, supported by walling off and use of the combined pressurized working method, which have obtained preliminary successes. But in overall terms, this problem has not yet been solved, and it is a key technical problem. We are organizing further experiments and an expanded scale of testing aimed at achieving normal extraction.

About 10 billion tons of coal is compressed under buildings, water bodies and railroads. Experimental studies have allowed the extraction of more than 250 million tons in the last 30 years. Currently the ministry is drafting a series of regulations for extracting this type of coal and is further studying a variety of measures to expand the scope of working of such coal and increasing recovery rates.

5. Strengthening Geological Exploration and Reserves Management, and Decreasing Resource Waste

There are rather many problems in this area, but the primary ones are that the accuracy of geological surveying is not great, coal mine geological work is inadequate, and reserves management is unsatisfactory. For instance, reserves are lost through failure to understand geological structure, some seam thickness is lost through failure to determine seam thickness, and a lack of strict resource management has resulted in reported recovery rates which are always higher than actual recovery rates, thus covering up resource losses.

In order to improve work in this area, the various offices and mines have started or are now starting to restore or establish geological exploration organizations and resource management organizations, to make their duties clear, and to establish a complete resource management system.

In order to increase surveying accuracy, emphasis is currently being placed on studying and developing digital seismic prospecting and digital well logging techniques. A digital coalfield seismometer developed by this country will be completed and tested this year. In addition, downhole physical exploration methods and the corresponding text instruments are being studied, and the three-dimensional photographic measurement method is being studied for use in determining downhole geological characteristics. A 300-meter hydraulic in-mine geological drill is being developed to strengthen mine geology work.

8480
CSO: 4013/91

COAL

NEW RAILROADS, PORT FACILITIES, SLURRY PIPELINES PLANNED FOR SHANXI

SK161041 Taiyuan SHANXI RIBAO in Chinese 19 Mar 83 pp 1, 3

[Excerpts] In order to achieve the grand national economic quadrupling objective and accelerate export of Shanxi coal, the Provincial Planning Commission, with the support of relevant State Council departments, from 12 to 17 March held a meeting in Taiyuan to "expound and explain the validity of the communications, transportation, postal and telecommunications plans for construction of Shanxi's energy, heavy industrial and chemical industrial base."

Attending the meeting were 300 leaders and experts from 145 units, including departments, commissions and bureaus under the State Council, provincial and city transportation departments, provincial departments, committees, offices and bureaus and prefectural and city planning commissions, transportation bureaus, scientific research institutes and schools. Also attending were Zheng Guangdi, vice minister of transportation; Li Kefei, vice minister of railways; Zhu Gaofeng, vice minister of posts and telecommunications; Guo Hao, deputy director of the State General Administration of Civil Aviation; and responsible persons of the provincial CPC committee and government, including Wang Kewen, Guo Qinan, Jia Chongzhi and Wang Xi.

Twenty-three experts and scholars spoke at the meeting. The major points of the railway planning are: speed up the technical transformation of the old lines and concentrate on the construction of new lines. To be more specific, in the next 8 years, technical transformation will be carried out for the Jing-Bao, Jing-Yuan, Shi-Tai, Han-Chang, Tai-Jiao and south-north Tong-Pu old railway lines; the new Da-Qin, Suo-Shi and Hou-Yue railways will be opened; in Shanxi Province, the Yang-She, Xiao-Liu, Shen-He, Wu-Mo, Lin-Tai, Hong-Gu, Qin-Jie, and Yu-Jia feeder routes will be constructed and transformed so as to ship out Shanxi's coal through various channels, with great capacity in a modernized way. The major point of highway planning is: technically transform main highways, build county-commune highways, pay close attention to construction of highways on which coal delivery is concentrated and new highways for delivering coal to other provinces, speed up revamping of vehicles, make a success of coal transportation within the province and, under conditions of inadequate railway transport, shoulder responsibility for long-distance coal delivery to other provinces. The major points of the water transport planning are: expand port berths and inland water transportation of coal, coordinate water transport with railway transport and increase the annual inshore and inland river coal shipping capacity to 120 million tons by 1990. Some departments also put forward plans for coal slurry pipelines and the proposal to have civil aviation share some of the railways' burden in carrying passengers.

CSO: 4013/185

COAL

JOINT CHINA-JAPAN COAL LIQUEFACTION PROJECT COMPLETED

OW211419 Beijing XINHUA in English 1211 GMT 21 Apr 83

[Text] Beijing, 21 Apr (XINHUA)--China's first continuous coal liquefaction unit with a daily processing capacity of 100 kilograms was completed and put into use here today.

Major equipment of this unit was funded by the New Energy Development Organization of Japan, and designed and manufactured by the Mitsui Engineering and Shipbuilding Co Ltd. Chinese and Japanese technicians joined Chinese workers in building the liquefaction unit.

Speaking at a ceremony held for the completion of the unit, He Bingzhang, president of the China Coal Society, said that the event marked the beginning of cooperation between the two sides in developing liquefaction technology.

"Our goal is to realize the industrialization of coal liquefaction so that the process may benefit the people of both countries," he said.

In reply, Tsutomu Watamori, president of the New Energy Development Organization of Japan, said that the completion of the unit "illustrated the good cooperation in energy between Japan and China."

Sources said that in coal liquefaction, China is also contacting other countries and international organizations. Negotiations on a similar project are now being held with the Federal Republic of Germany. The United Nations has assisted China with the training of personnel and the purchase of instruments and meters needed in the coal liquefaction effort.

Coal liquefaction may help do away with inconveniences in using and transporting the solid mineral, and reduce air pollution caused by the coal smog. It may also be used as a new source of energy to make up for the shortage of oil, or to replace it.

According to coal scientists, 1 ton of quality coal may produce more than 300 kilograms of man-made petroleum through liquefaction, but the cost is high.

Gao Yangwen, minister of coal industry, and President Tsutomu Watamori cut the ribbon at the unit's opening ceremony.

Among those present on the occasion were Fan Weitang, president of the Chinese Coal Mining Research Institute and officials of the Japanese Embassy in Beijing.

CSO: 4010/56

COAL

WAYS TO INCREASE ECONOMIC BENEFIT OF COAL INDUSTRY ENTERPRISES

Taiyuan JISHU JINGJI YU GUANLI YANJIU [RESEARCH ON THE ECONOMICS AND MANAGEMENT OF TECHNOLOGY] in Chinese No 4, 31 Dec 82 pp 54-56, 35

[Article by Li Shaoxun [2621 4801 8113] and Ji Zhongshi [0370 0022 2514]: "On Ways To Improve Economic Benefit of the Coal Industry Enterprises"]

[Text] The coal industry is an important industry in the national economy. Exerting efforts to improve the economic benefit of the coal industry enterprises and to promote national economic development are important theoretical and practical questions before us.

There are many ways to improve the economic benefit of coal industry enterprises. Here, we will talk about several ways in view of some actual situations at the seven mining bureaus in Shanxi Province:

I. The Output of Raw Coal Must Maintain a Steady, Stable Growth Rate

China's energy structure is based primarily on coal and then on hydroelectricity. Coal, in the near-term and in the future, will be an important fuel needed in the national economy. Without sufficient coal and other energy, our buildup of the four modernizations will be seriously hampered. We can say that the rate of progress in our four modernizations is determined to a great extent by the rate of growth of energy, and mainly the speed of growth of coal as an energy source. Industry, agriculture, transportation and other industries and professions and people's lives all require the coal industry to have a definite rate of development. This rate is guided by state plans and it increases year after year. At the same time, it is also stable and does not fluctuate vastly.

This is because in view of the objective patterns of coal production, coal reserves are always limited. If we do not consider the design capacity and the reserves of coal and blindly intensify mining, we will surely hasten the aging and abandonment of coal mines, forcing the nation to build new mines to replace them. This will increase the pressure on capital construction and increase the burden on the national economy. The history of coal mining since the founding of the nation has fully demonstrated that by not considering the objective economic laws and production procedures, the loss created by pursuing high output, intensive efforts, mining the rich and abandoning the poor, mining the thick seams and abandoning the thin seams, mining superior quality and abandoning poor quality coal, mining the easily mined deposits and abandoning the deposits that are difficult to mine, mining without plans and digging without plans has been shocking. At the end of the 1950's and the beginning of the 1960's, because of the leftist influence, the output of raw coal by the seven bureaus directly under the jurisdiction of Shanxi Province and the profit realized showed a big difference. The output in 1962 was 8.72 million tons less than that in 1960 and the profits dropped from more than 146 million yuan in 1960 to just a little over 1 million yuan in 1962. This lesson is very profound.

In view of the actual situation at the seven uniformly equipped bureaus in Shanxi Province, hastening the speed of development and improving economic benefit are mutually sustaining and mutually stimulating. In 1978, the 7 mining bureaus produced a total of 54.44 million tons of raw coal. By 1982, the output of the 7 bureaus reached 61.86 million tons, an increase of 13.61 percent over 1978, an average growth of 2.47 million tons in output each year at a growth rate of 4.3 percent. In 1978, the 7 mining bureaus realized a profit of 256.65 million yuan. By 1981, this reached 569.92 million yuan, an average annual increase of 104.42 million yuan in profits. The profits of the seven mining bureaus were different because of the difference in objective conditions, but each ton of coal could realize a profit. The output of coal of these seven bureaus and the profits of the enterprises were directly proportional. The more they produced, the greater the profit, the less they produced, the smaller the profit. In 1981, 22 of the 37 mines of the 7 bureaus directly under provincial jurisdiction showed increased profits from increased output when compared to the plans, i.e., they increased output and increased revenue. For example, the Gushuyuan Mine of the Jincheng Mining Bureau produced an increased output of 100,000 tons compared to 1981. The profit per ton of coal at this mine in 1981 was 14.07 yuan. The increased output alone generated an additional revenue of 1.4 million yuan. We advocate unification of speed and benefits, oppose speed that produces poor economic benefits and large profits.

II. We Must Exert Efforts To Reduce the Cost of Producing Raw Coal

Exerting efforts to reduce the cost of producing raw coal means reducing the consumption of material labor and live labor. It is an important subject in improving economic benefits. The cost of raw coal produced by the 7 bureaus directly under the jurisdiction of Shanxi Province in 1978 was 13.47 yuan/ton. In 1981 it was 16.23 yuan/ton, the cost per ton increased 2.76 yuan. This is mainly because of the increase in policy factors. The 14 policy factors that could be statistically accounted for increased the cost by 2.94 yuan, not including the factors that could not be calculated, such as fees for environmental pollution, mark-up on the three categories of commodities, the elevation of interest rates. After deducting these factors and using comparable parameters for calculation, the cost in 1981 showed a drop of 0.18 yuan/ton from 1978 and a net gain in revenue of 11.13 million yuan.

Materials consumed by the coal enterprises in mining and tunneling alone include mainly pit logs, metal props, roof beams, dynamite, detonators, and electricity. The electromechanical and shipping fronts mainly consume accessories and large materials. At present, high consumption of materials, great wastefulness and poor management are widespread among coal industry enterprises. At some units, the tunnels are irrationally arranged, some use inappropriate props, some consume too many pit logs, some have lost a lot of metal supports, and some seriously waste cement, blocking materials and rock. All of these directly increase the cost of the enterprises and bring about loss to the economic benefit of the enterprises. The practice at the seven mining bureaus in Shanxi Province showed that in order to conserve the consumption of major materials, we must grasp conscientiously and well the following aspects:

1. We should insist on using metal props.

2. We must strengthen management.

3. We must strengthen recovery and recycling.

4. We must strengthen management of materials of the two fronts.

Another important subject in improving economic benefits and exerting efforts to reduce cost is to improve the labor production rate. Coal enterprises throughout the whole nation generally have many employees and a low efficiency. The whole staff labor production rate is less than 1 ton per worker. Although the whole staff labor production rate at the seven bureaus directly under the jurisdiction of Shanxi Province is higher than that of the whole nation's coal profession because of geological conditions and such objective factors and subjective efforts, but the development between bureaus is uneven, and there is a great difference. Even when comparing the mines of one bureau, this rate is not the same. Conscientiously reducing labor consumption and improving labor efficiency are problems that urgently need to be solved in improving the economic benefit of coal enterprises.

How can we improve the labor efficiency of coal enterprises?

1. We must strengthen labor management, correctly implement the policy of each according to his work, pay for piece work, and fully mobilize the enthusiasm of the workers.

Man is the most active factor in all of the factors of productivity. Improving labor efficiency requires people who are self-aware and who have technical know-how. We must strengthen labor management, make labor discipline strict, make the various post responsibility systems sound through a series of measures, improve the attendance rate of workers and the rate of utilization of work hours, and on this basis, we must correctly implement the policy of distributing work according to labor ability and implement the system of paying for piece work.

2. We must exert efforts to improve the technical caliber of workers.

Exerting efforts to improve the technical caliber of workers and carrying out intellectual development are important ways to improve the labor production rate. For several years, the seven mining bureaus directly under the jurisdiction of Shanxi Province used various methods to organize the workers to learn culture, technology, and operation. This enabled the workers to know what they should. Efforts were exerted to improve the standard of technical operations, and technical revolution and technical renovation based on production practice were carried out, and the potential of people and equipment was fully developed. The Comprehensive Mining Team No 1 of the Tongjialiang Mine of the Datong Mining Bureau produced over 1 million tons of coal in 1981, creating a record on an international level. They received half a year of full time training before engaging in production and also grasped off duty training. Each week, they learned technology during after work hours 2 days a week, they continued their learning without stop, they improved the technical standards of the broad number of workers, and stimulated improvement in labor efficiency. From 1975 to 1981, the average work efficiency in stoping reached 43.55 tons/man-day.

3. We must popularize and use new technology and new equipment in a big way.

The actual application of new technology and equipment in industrial enterprises is an important means to reduce the consumption of live labor and to improve labor efficiency. The seven mining bureaus of Shanxi Province began using mechanized equipment for comprehensive coal mining since 1974. After several years of practice, comprehensive mining equipment has already fully developed the superiority of high output, has been highly efficient and safe. Facts show that persisting in the direction of mechanized coal mining and continuing to improve the degree of mechanization of coal mining are the fundamental ways to improve labor efficiency of coal enterprises and to reduce the consumption of live labor. Of course, starting out from the actual situation in our nation, our principle should be to implement indigenous and foreign methods together, and carry out comprehensive mining, general mining and blast mining together.

III. We Must Exert Efforts To Improve the Quality of Coal, Increase the Varieties and Specifications

The quality of coal and the varieties and specifications are directly related to the value and the usefulness of coal. They have a decisive function in the microcosmic economy of coal enterprises and the macrocosmic economy of the national economy. They are the fundamental marks of whether the economic benefit of coal enterprises can be developed or not. The fundamental method to improve the quality of coal is to develop the washing industry, and improve the preliminary processing of coal. The percentage of washing of coal in our nation is very low, and compared to developed nations, the gap is wide.

Nation	Japan	France	Britain	Germany	Soviet Union	China
Washing of raw coal (percent)	94.7	92.5	88.3	87.4	63.4	18.0

The amount of raw coal of Shanxi Province being washed is the lowest among the nation's major coal producing provinces.

Province	Liaoning	Guizhou	Hebei	Shandong	Heilongjiang	Shanxi
Washing of raw coal (percent)	73.6	60.0	43.05	40.5	32.0	9.0

The above statistics show fully that the percentage of washing of raw coal of Shanxi and our province is very low. In particular, the percentage of raw coal of Shanxi being washed is only half of the nation's percentage, far from suiting the needs for national economic development. This has brought about a serious effect upon the development of the economic benefits of coal. This situation is mainly due to less investment appropriation. Take Shanxi as an example. Up to 1979, investment in the coal industry was 3,369,000,000 yuan while investment in coal washing was only 101.8 million yuan, constituting only 3.2 percent. In addition, screening is also very backward. This is because of the increase in mining coal seams with a high ash content and the improvement in the degree of mechanization of mining and tunneling, thus leading to a drop in the quality of coal and a reduction in the varieties and the specifications. The prices of coal dropped and the gain lessened, as manifested mainly in the following:

1. A high ash content, more waste rock have reduced the price of coal and reduced the income of enterprises. Take the Datong Mining Bureau as an example. For every 1-percent increase in the ash content of raw coal, the selling price per ton drops 7 jiao and for the whole year, this means a reduction of 16 million yuan in revenue. This is a very large figure.

2. The pressure on railroad transportation has been increased. For the nation's uniformly equipped coal mines, over 80 percent of the coal transported by railroads is raw coal. Each year, over 4 million tons of additional waste rock are shipped, wasting more than 18 billion ton-kilometers of transport capability.

3. The varieties and specification are inappropriate, thus creating a large loss of thermal energy and affecting the macroeconomic results of the entire national economy.

The above facts show fully that in order to develop the economic benefit of coal enterprises, we must carry out preliminary processing, improve quality and increase the varieties and the specifications.

IV. Comprehensive Utilization, In-Depth Processing, and Comprehensive Business Operation Are the Fundamental Transformations of the Operational Principle of Coal Enterprises and Are Necessary To Improve Economic Benefit

Coal is not only a fuel, it is also an important chemical raw materials. The coal enterprises can utilize joint capital and management to stimulate development of a coal-based chemical industry. There are many varieties of such products, including coke, coking furnace gas, tar, coarse benzene, and ammonium sulfate. These products can be processed to produce man-made fibers, plastics, chemical fertilizers, fire-proof materials, dyes medicines, glues, asphalt, phenol and tar acid. Some people calculated that if the value of fuel produced from coal is set at 1, then processed coal tar can increase this value by 10 times, processed plastics can increase this value by 90 times, processed synthetic dyes can increase this value by 375 times, manufactured man-made fiber can increase this value by 1,500 times. It can be seen that the in-depth processing of coal has a high value and a high benefit. The coal enterprises in the nation and in Shanxi Province, at present, have only begun to touch upon this problem. Conscientious research and practice are urgent tasks facing us.

Coal enterprises can also provide heat, gas and electricity to industrial and commercial enterprises, towns and factories and mines. At present, Shanxi Province has built a pit-mouth power station in Datong. Practice shows that this is a good way fully to utilize coal resources and reduce the pressure on transportation. The Yangquan Coal Mining Bureau has always insisted on extracting and utilizing gas for the past several years. It has solved the problem of fuel for cooking by 7,500 families and for 10 boilers and large messhalls. Each year, about 50,000 tons of coal can be conserved. At the same time, they also utilized gas to manufacture carbon black and formaldehyde. The value of each ton reaches about 500 yuan.

The treatment of waste rock by coal enterprises is a major problem. If it is not handled well, waste rocks will fill up good land and pollute the environment. An important subject of comprehensive management is the treatment of the three wastes. The waste rock brick factory of the No 1 Mine of the Yangquan Mining Bureau can now manufacture 12 million waste rock bricks each year. It processes 34,000 tons of waste rock and can make a profit of over 200,000 yuan.

The waste water of the mines of the Wuyang Mine of the Luan Mining Bureau used to be released into the river. This polluted the water source. After comprehensive treatment, it was able to reduce its antipollution fines by 58,000 yuan and the water could be used to irrigate 4,000 mu of farmland, 1,000 mu of fruit gardens and for building 500 mu of fish ponds. Waste was turned into treasure, the harmful was changed into the beneficial, and industry and agriculture all benefited. All of these show that comprehensive operation, in-depth processing, comprehensive utilization by the coal enterprises have a bright future and the benefits are great.

There are many ways to improve the economic benefit of coal industry enterprises and the subject is rich in content. Of course, they are not limited to the above. As long as the leadership of each enterprise improves understanding, summarizes experience, implements truly effective measures, the economic benefit of coal enterprises will surely be improved greatly and the contribution to the state will become greater and greater.

9296
CSO: 4013/104

COAL

BRIEFS

NEW COAL RAILROADS, PIERS--The double-track Zhengzhou-Xuzhou section of the Long-Hai Rilaroad /Lianyonggang-Lanzhou/, the main route for the eastward shipment of Henan and Shanxi coal, has been completed and turned over for operation. Its capacity will be nearly doubled. The Shi-Tai Railroad /Shijiazhuang-Taiyuan/ is now fully operational. This trunk line, with a total length of 235 kilometers, is part of the route for the outbound shipment of Shanxi coal. The laying of track for the Yan-Shi Railroad, which will link the harbor to the Yanzhou coal base, has begun. The main construction work on the special coal pier at Shijiu Harbor is under way. The first stage includes a 10,000-ton and a 25,000-ton berth. The planned annual export capacity will be 15 million tons. /Excerpts/ /Beijing GUANGMING RIBAO in Chinese 6 Feb 83 p 2/ 8480

NEW NEI MONGGOL MINES--The state has decided that Nei Monggol is one of the nation's focal points for energy development. Development of the Huolinhe, Yiminhe, Yanbaoshan, and Jungar open-pit coal mines has already begun and by the end of this century, Nei Monggol's coal output will reach 200 million tons, increasing the province's share from its present one-thirtieth of national output to one-sixth. /Excerpt/ /Beijing GUANGMING RIBAO in Chinese 6 Feb 83 p 2/ 8480

HENAN COAL PRODUCTION--Coal mines at and above county level in Henan produced 12.27 million tons of coal in the first quarter, an increase of 2.77 percent over the same period last year and 410,000 tons more than the plan. Various mining bureaus, including Pingdingshan, Jiaozuo, Hebi, Yima and Hanzhuang, overfulfilled their state plans. [Text] [HK041219 Zhengzhou Henan Provincial Service in Mandarin 1100 GMT 3 Apr 83]

SHANDONG COAL PRODUCTION--Prefectural, county and commune collieries across Shandong Province have prefulfilled the first quarter's raw coal output target, 4 days ahead of schedule. By 27 March, the collieries produced over 2,713,500 tons of raw coal, accounting for over 25 percent of the annual output plan. [Text] [Jinan Shandong Provincial Service in Mandarin 2300 GMT 28 Mar 83 SK]

GUANGDONG COAL PRODUCTION--The Guangdong Provincial coal industrial front overfulfilled the state raw coal production quota for the first quarter of this year by 6.3 percent, 6 days ahead of schedule. [Text] [HK061535 Guangzhou Guangdong Provincial Service in Cantonese 1100 GMT 5 Apr 83]

NEW ANHUI COAL MINES--Hefei, 20 Apr (XINHUA)--Construction of a new coal mine with an annual capacity of 3 million tons is nearing completion in a coal mining center of Anhui Province, East China. The Panji No 1 coal mine on the northern bank of the Huai He in Anhui is one of the biggest under construction in China. Facilities for ventilation, pumping, transport and communications have been built. The mine is expected to go into production in September this year. The mining area is set in an alluvial plain. The geological structure is complicated. Chinese engineers developed the techniques needed to construct the mine after 10 years' study. Two more mines with similar capacity are also under construction in the area. [Text] [OW201230 Beijing XINHUA in English 1148 GMT 20 Apr 83]

CSO: 4010/54

OIL AND GAS

CRUDE OIL PRODUCTION STABLE AT 100 MILLION TONS A YEAR

Beijing JINGJI RIBAO in Chinese 5 Feb 83 p 2

[Article by Chen Zhongyong [7115 1813 0516]: "Why Is China's Crude Oil Production Stable Year After Year?"]

[Text] In 1982 China produced 102 million tons of crude oil, 2 percent above the quota and 0.8 percent above the 1981 level. In that year China exported 14.67 million tons of crude oil. As of 1982, China's crude oil production had stabilized above the 100-million-ton level for 5 consecutive years. As we remember, Premier Zhao Ziyang pointed out in his work report to the Fourth Session of the Fifth National People's Congress: "Not too long ago people asserted that China's crude oil production would gradually decrease and before long China would change from an oil exporting country to an oil importing country. I can assure everyone that there is no way this situation can occur." Reality has proven that Premier Zhao's judgment was absolutely correct.

The reason that China has been able to stabilize its oil production above the 100-million-ton level for 5 consecutive years has been due mainly to the production of old oil fields such as Daqing, Shengli and Huabei. Today, the old oil wells in these oil fields have mostly entered the natural stage of decreasing production with an overall annual rate of decrease of 10 percent. In other words, 10 million tons of crude oil per year must come from various measures to increase production to compensate for the natural decrease in order to reach the national 100-million-ton target of crude oil production. The oil fields have made major efforts to stabilize the production of crude oil, mostly by forcing water into the strata to maintain the pressure and pumping the oil with heavy pumps. A series of scientific experiments and analyses have been conducted to assess the oil and water distribution changes for increased water injection. For example, Daqing oil field tests the underground strata conditions of 1,500 oil wells each year. Every quarter the water absorption of each water injected well is measured section by section and every few years some closed sampling wells are drilled to analyze the oil and water saturation rates. In 1982 a total of 310 million cubic meters of water was injected into oil wells in China, 72,000 downhole operations were performed, and 2,900 wells were drilled.

Today, a good number of the old oil fields in China have reached the stage of moderate to high water content but there are still sufficient resources to maintain the 100-million-ton crude oil production and to strive for new gains in the period of the Sixth Five-Year Plan. First of all, a number of scientific and technological projects on oil field development have produced results. Studies of oil stratum structure and oil reserve situation in petroleum engineering research and the development of oil recovery in oil wells within moderate to high water content have made considerable progress in production practice. Such results are currently being promoted to increase the recovery rate and to prolong the life of old oil wells. Secondly, some regions of developed oil fields still have a low yield and a portion of the reserves in fields with low permeability and high viscosity have not been exploited. Oil field development departments have proposed designs to increase oil production by at least 30 to 40 percent by water injection, pressure fracture, and deep well pumping. It is expected that during the period of the Sixth Five-year Plan the Chinese petroleum industry will certainly make new achievements and new contributions to the strategic goal of developing our national economy.

9868
CSO: 4013/151

OIL AND GAS

WAYS TO ACCELERATE NATURAL GAS EXPLORATION AND DEVELOPMENT PROPOSED

Beijing SHIYOU KANTAN YU KAIFA [PETROLEUM EXPLORATION AND DEVELOPMENT] in Chinese No 1, 1983 pp 1-3

[Article by Qin Tongluo [4440 0681 3157]: "Some Opinions on Accelerating the Exploration and Development of Natural Gas"--speech to the Natural Gas Industry Workshop (Abstract)]

[Text] In today's world, natural gas is an important energy source as well as a chemical raw material. In recent years, it has developed very quickly in some nations and some people have estimated that natural gas and coal and petroleum together constitute the three pillars of the world's energy today. Judging from China's geological conditions, natural gas has a good future. We should accelerate the exploration and development of natural gas to satisfy the ever-increasing needs of the national economy.

I

This workshop has already discussed the problems of coal-formed gas. The condition of genesis of natural gas is much wider than that for petroleum: 1) The source material for the genesis of gas can be sapropelic (related to the genesis of oil) and it can also be humic (related to the genesis of coal), what this conference has called coal-formed gas; 2) The upper and lower limits of the "heat window" for the genesis of gas are much wider than those for oil genesis; and 3) Natural gas can also be formed by microorganic activity, i.e., it can form and accumulate under shallower, newer conditions and lower temperatures.

But the formation of all natural gas deposits must undergo the processes of migration and concentration, otherwise the natural gas formed will be dispersed and have no exploitable value. The general pattern of migration and accumulation of natural gas is basically similar to that of other liquid minerals (mainly petroleum), therefore, regardless of the course of genesis of natural gas, the techniques of prospecting for natural gas deposits and the techniques of prospecting for petroleum are not different in principle. The technicians of seeking oil can be completely used to find gas, and the development of gas fields and the development of oil fields are to a large degree similar.

Because of the difference in the causes of formation and the nature of natural gas and petroleum, the following points must be noted in the course of seeking gas:

1) We can look for gas in oil-bearing basins and in coal-bearing basins, the range of prospecting is broad;

2) We can find gas in deep layers as well as shallow layers, for example, natural gas deposits of the Quaternary System have been discovered in China, and the depth of natural gas deposits has a greater range than that of petroleum;

3) Because the fluidity of natural gas is better than that of petroleum, it is easily dispersed, and this requires better conditions of preservation. But because of its good fluidity, it can enter small pores much easier, therefore, its requirement for the conditions of the layer of deposit is lower than that for petroleum.

The several points above must be fully noted and estimated by our petroleum workers when looking for gas.

II

Summarizing the above, we must note the following points in the course of exploring and developing natural gas on the basis of current petroleum exploration and technology of development:

A. Because natural gas deposits can be discovered at greater depths than oil deposits (according to drilling depth data available in the world today, deposits found below 5,000 meters are basically all gas deposits), we need to study and develop deep layer seismic technology.

B. The difference in density of natural gas and water is very great, therefore, in gas-containing and water-containing geostrata, the velocity of seismic waves also differs greatly. The gas and water boundary has a strong ability to reflect seismic waves, which become visible after special processing of seismic recordings. For this, we need to further study and develop such methods as bright spot technology and to process seismic recordings in various special ways.

C. We need to study and develop deep well drilling technology and technical processes, solve corresponding problems with drilling and tunneling tools (such as drill bits) and high temperature resistant and superior quality mud. It is more difficult to prevent blowouts in natural gas wells than in oil wells. We must develop and improve technology and equipment to prevent blowouts.

D. We must improve well logging techniques and methods and be especially careful not to miss shallow gas layers. For this, we must take more core samples from shallow detritus. Because gas layer cuttings are unlike those of oil layers, which can be observed and recognized by color, and because even under fluorescent light it is difficult to recognize them, we must observe fresh cuttings promptly. Gas test well logging is a very effective measure to determine gas layers. Well working teams working in new prospecting areas must be equipped with gas testing devices as much as possible and personnel must be trained to use them.

E. Intrusion and forced replacement by mud in natural gas layers are much stronger than in oil layers and interpretation of the results of well logging must take this into consideration. When necessary, wells that have been logged must relog after a certain period. Combined sound wave density well logging is very effective in differentiating gas layers. Temperature well logging and neutron life well logging are also useful in recognizing gas layers. We must select rational well logging techniques and develop and perfect corresponding well logging techniques and equipment. It has already been proven that noise well logging is useful in recognizing gas layers. We must quickly acquire such capability. We must pay more attention to the interpretation of dense layers indicated by well logging and strata showing gas or other indications to avoid omissions.

F. In new prospecting areas and new prospecting wells in old areas or in specific gas prospecting wells, doubtful positions must be tested promptly, therefore it is necessary to develop technological processes and equipment for midway tests.

G. The large-scale acidification cracking technique has proven to produce visible increased output from natural gas wells, especially from dense natural gas layers. Therefore, we need to study and develop the technology and equipment for the large-scale acidification cracking technique.

H. Unlike the extraction of petroleum, the rate of extraction of natural gas is the highest under gas driven conditions. Therefore, in the course of developing natural gas deposits, we must study and develop a complete set of techniques to prevent and control water and to handle the emergence of water from gas wells.

I. Natural gas often contains such acidic gases as CO_2 and H_2S. Especially when the gas contains small quantities of water, it has a very strong corrosive property. Before transmitting commercial natural gas, treatment is necessary. The construction of gas treatment plants should be a part of the buildup of gas mines, and they should be buil simultaneously with the development of gas fields to avoid delays in the transmission and utilization of gas.

J. The problem of natural gas storage and transmission during the course of development is more important than that for petroleum. When developing gas fields, we must consider this factor and build accessory facilities promptly.

In addition, we must also consider the important fact that the plan for the development of natural gas fields is greatly affected by the users. This is indeed different from the requirement for determining the development of oil fields which involves only an economic analysis of the various plans to determine in general the best development plan. To guarantee that a region can steadily supply gas, we may also consider designing development plans with the unified goal of providing the optimal supply of gas from a group of gas fields.

III

To accelerate the exploration and development of natural gas, the following suggestions have been proposed:

A. According to present prospecting and development capabilities, we should consider the degree of difficulty in preparatory work and in utilization, and it would be beneficial to concentrate forces at the several basins already known to have a richer content of oil and coal. These regions are northern China, Sichuan, and Erdos. In addition, we must also study the rational utilization of gas in the shallow layers of the Chang Jiang Delta.

B. Some special personnel in related departments should be assigned to study and manage the work of prospecting and developing natural gas. At present, the time to establish a special agency has not yet come. We must prepare conditions.

C. In the next several years, we must draw up separate plans and projects for prospecting natural gas and appropriate special funds to guarantee the projects. The examination of the production indices for natural gas must be regarded as important as indices for the production of petroleum.

D. In regions where prospecting for petroleum has already been conducted (also including prospecting for coal), all geological data, geophysical data and drilling and prospecting data must be conscientiously double checked once, and some necessary well logging and testing work must be conducted to find natural gas deposits that may have been omitted or neglected in the past.

E. Newly built oil fields of the future must simultaneously build systems for the gathering, treatment, transport of associated gas and a system of concentrating oil and injecting water. They should begin operation early and be utilized. The system for collecting gas in oil fields must be completed gradually in a key way wherever possible. The utilization of gas from coal mines must be further tested.

F. We must improve coordination among related departments. Comprehensive departments at the higher level must hold coordination meetings at fixed intervals, exchange experience and geological data, study and determine the regions for further work, the direction and the topic of study, and the division of work of the next step must be coordinated.

G. Each related department should gradually establish special research agencies, train personnel, fill the research ranks, and provide scientific and technological guarantees to do this work well.

H. Scattered low pressure natural gas deposits must be utilized locally as much as possible, and corresponding policies to encourage development must be established.

I. The present price of natural gas is low, and it is unfavorable to the development of the natural gas industry. It is hoped that appropriate measures can be taken on the basis of investigation.

China is a nation with very rich coal and petroleum resources. We have mentioned before that in the course of oil and coal genesis, a large amount of natural gas can form simultaneously. Therefore, all nations with more output of oil and coal are without exception also nations that produce a lot of gas. Although China has already discovered many natural gas deposits and the annual output has also surpassed 10 billion cubic meters, compared to the reserves of coal and petroleum already discovered, it is still low. We believe, as long as our understanding remains consistent, and as long as the measures are appropriate and effective, that our natural gas industry will surely develop greatly in the near future.

9296
CSO: 4013/170

PROSPECTS SAID BRIGHT FOR EXPLOITING QAIDAM OIL, GAS

HK180225 Xining Qinghai Provincial Service in Mandarin 1100 GMT 17 Mar 83

[Text] The Qinghai Provincial Government held a report meeting on 15 March on prospects for exploiting the oil resources of the Qaidam region. (Zhang Deguo), secretary of the CPC Committee of the Provincial Petroleum Administrative Bureau, made a report. His report was in three parts: 1) the work and achievements of the Provincial Petroleum Administrative Bureau in the past 29 years; 2) there are good long-term prospects for developing the petroleum industry in Qaidam; 3) applying the spirit of reform in tackling all work and create a new situation.

Oil prospecting in the Qaidam Basin began in 1954 and has been going on for 29 years. During this period, workers have drilled over a prospecting area of nearly 100,000 square kilometers and initially built up an oil base in an uninhabited wilderness.

On the outlook for developing oil prospecting at Qaidam, (Zhang Deguo) said: There is an extensive area of gas at Qaidam, and there are big oil and gas deposits and many oil-bearing layers. After 1978, a high pressure, high-yield gas and oil field was found in a deep layer in western Qaidam. This is the (Gasikule) field, following that, industrial oil deposits were found in the Nanmasi area of western Qaidam and in the western part of the Youshashan Mountains; and oil was also found at Shizigou and (Lutoushan). In addition, conditions for the presence of oil exist throughout broad areas of the Qaidam region. Further prospecting and exploitation must be conducted.

Comrade (Zhang Deguo) said: At present, the Provincial Petroleum Administrative Bureau has 19,000 workers. This force has been working for a long time under difficult conditions. It has glorious traditions of struggling amid difficulties and overcoming problems. It has also trained a force of prospectors and researchers, thus creating conditions for the development of the petroleum industry in Qinghai.

Comrade (Zhang Deguo) said in conclusion: There are fine prospects for oil exploitation at Qaidam. There are also many difficulties facing us. However, we are resolved to overcome the difficulties. At the same time we welcome scientific and technical personnel concerned to assist in Qaidam oil prospecting and exploitation. (Ma Shiji), secretary general of the provincial government, presided at the report meeting. Over 800 persons from concerned provincial and city departments attended.

CSO: 4013/162

OIL AND GAS

BRIEFS

NATURAL GAS POWER GENERATION--Beijing, 25 Feb (XINHUA)--Natural gas recovered in the process of petroleum production at the Zhongyuan oilfield in Henan Province--once burned as waste--is now being used to power electrical generating units, according to a report in today's PEOPLE'S DAILY. Utilized at the trial stage since 3 January this year, 17,000 cubic meters of natural gas were used every day for mixed burning with coal. Tests indicate that 30 tons of coal are saved each day and that the firing is stable. The proposed use of natural gas resources was made by Sun Zhenshan and Zhang Qingchun of the Henan Technical Economy Research Center. An estimated 800,000 cubic meters of gas was recovered daily from petroleum production, according to 1983 figures. Of this, 400,000 to 500,000 cubic meters were utilized while the rest were burned off. [Text] [OW132355 Beijing XINHUA in English 1204 GMT 25 Feb 83]

CSO: 4013/162

DETAILS OF NATION'S FIRST NUCLEAR POWER PLANT PRESENTED

Beijing XIANDAIHUA [MODERNIZATION] in Chinese Vol 5, No 1, 25 Jan 83 pp 22-23

[Article by Feng Zejun [7458 3419 0689] of the 728 Engineering Research and Design Institute of the Ministry of Nuclear Industry: "China's First Nuclear Power Plant"]

[Text] The first nuclear power plant designed by China, a 300,000-kilowatt pressurized water reactor power plant, will be built on Hangzhou Bay near Shanghai. This nuclear power plant was originally approved in August 1972, hence its name, "Project 728." Premier Zhou received the responsible comrades and design personnel of Project 728 three times during his lifetime, and proposed the 10-character policy of "safety, economy, practicality, and self-reliance."

Preliminary Work Progresses Smoothly

After the 3d Plenum of the 11th Party Congress, and especially during the past 2 years, work has progressed greatly. Preliminary work includes the series of tasks of scientific research, design, materials studies, research and development of equipment, plant site selection, and design of the plant housing. With the joint efforts of the Project 728 Research and Design Institute of the Ministry of Nuclear Industry and 100 or so units throughout the nation participating in the design, testing and equipment processing, 190 of the 264 research and testing projects have been completed. Of the 423 equipment designing tasks, 324 have been completed. Most of the 22 platforms needed for engineering tests have been built. The completed projects include: zero power test reactor for simulated reactor operations, test production of nuclear fuel components, the series of tests of hydraulic resistance, vibration, centering, strength, transport test, loading and unloading of nuclear fuel components. In addition, Shanghai has built the world's largest electrical slag remelting furnace to produce the large forged works needed in manufacturing the reactor's pressure tank. The prototype drive mechanism that operates the control rods to control the reactor also has been completed and tested numerous times. The fuel loading and unloading mechanism, and a fuel component, also have been successfully test manufactured.

Massive experimental work has been conducted to test and prove the design. The design was proved to be rational, the performance of the equipment completely satisfied the requirements, and the efforts have provided a reliable reference for batch production of equipment.

What Is a Pressurized Water Nuclear Reactor Power Plant?

At present, the reactors used to generate electricity in the world include the light water reactor, heavy water reactor, the high-temperature air-cooled reactor and fast neutron reactor. By the end of last year, 86.5 percent of the reactors used to generate electricity in the world were light water reactors. A light water reactor uses highly purified ordinary water as the coolant and as a neutron velocity reducing agent. Light water reactors can be further divided into two types, the pressurized water reactor and the boiling water reactor. The output of electricity by the pressurized water reactor constitutes 67 percent of the output of all light water reactors.

China's first nuclear power plant uses the pressurized water reactor as the power source (Figure 1). The outer casing of the reactor is a cylindrical high-pressure container, generally called the pressure vessel. The cap and the bottom seal of the pressure vessel are hemispherical domes. The outer diameter of the reactor is nearly 4 meters, and the height is over 10 meters, equivalent to the height of a four-story building. Not counting the weight of the interior structure of the reactor and the reactor core fuel components, the pressure vessel alone weighs more than 200 tons!

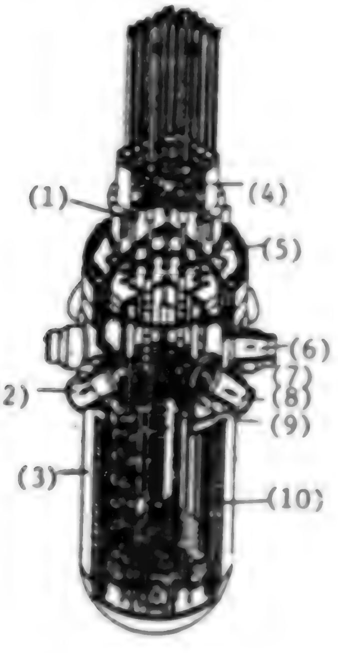


Figure 1. Ilustration of the Structure of the Pressurized Water Reactor

Key:

(1) Temperature measurement outlet
(2) Entry pipe
(3) Body of pressure vessel
(4) Drive mechanism of control rods
(5) Cap of pressure vessel
(6) Entry pipe
(7) Control rod components
(8) Exit pipe
(9) Fuel components
(10) Heat shield

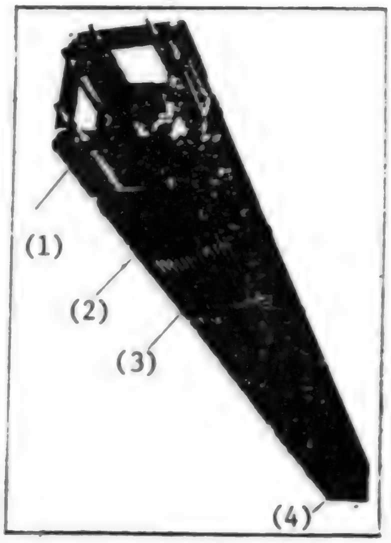


Figure 2. Nuclear Fuel Component

Key:

(1)	Upper pipe support	(3)	Positioning frame
(2)	Fuel component rods	(4)	Lower pipe support

The heart of the reactor is the core. It consists of the fuel component and control rods. The reactor core is commonly called the active area. The nuclear fuel component (Figure 2) is more than 3 meters tall and has more than 120 honeycomb boxes. They form a cylindrical cluster equivalent to about 2.5 meters in diameter. Each fuel component consists of more than 200 fuel element rods arranged in a square grid. The element rods are made of newly developed high-strength zirconium alloy tubes. The nuclear fuel of uranium dioxide is made into small pellets 10 millimeters long and over 8 millimeters in diameter. Each zirconium alloy tube contains more than 200 of these core pellets. Fission of the nuclear fuel occurs inside the element rods to produce a lot of thermal energy. The heat propagates outward from inside the element rods, passes through the coolant of the reactor core and the heat is continuously taken away. Because the coolant is enclosed in a hermetic high pressure system of more than 150 atmospheric units, the coolant can be heated to more than 300 degrees Celcius without boiling.

The cap of the pressure vessel of the reactor has a control rod operating mechanism. The control rods are made of materials that have a strong ability to absorb neutrons. The control rods can be moved up and down by the operating mechanism to control the rate of the chain reaction of fission of the nuclear fuel inside the fuel component. The control rod can be used to start up the reactor, regulate the power of the reactor and quickly shut down the reactor under emergency conditions. Among the more than 120 boxes of fuel, more than 30 boxes have such control rods.

How Does a Nuclear Power Plant Work?

The whole nuclear power plant can be divided into three main parts, i.e., the first circuit system, the second circuit system and the water circulation system (Figure 3).

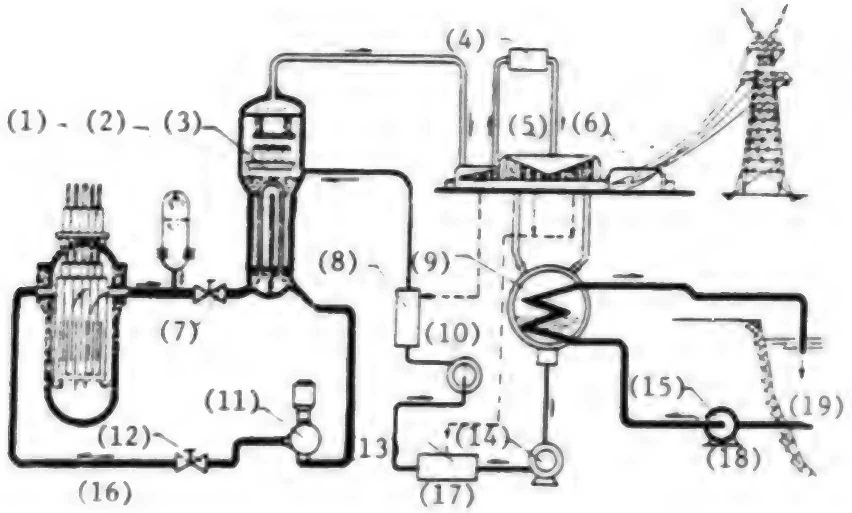


Figure 3. Illustration of the Working Principle of a Nuclear Power Plant System

Key:

(1) Reactor
(2) Pressure stabilizer
(3) Steam generator
(4) Reheater
(5) Steam turbine
(6) Generator
(7) Main valve
(8) High pressure water feeder and heater
(9) Condenser
(10) Water feeding pump
(11) Main pump
(12) Main valve
(13) Low pressure water feeder and heater
(14) Condensed water pump
(15) Recycled water pump
(16) First circuit system
(17) Second circuit system
(18) Recycled water circuit system
(19) River

The first circuit system is the hot water circuit. It consists of the reactor, the pressure stabilizer (which acts to maintain the stability of the internal pressure of this circuit system), steam generator, main pump and corresponding pipes and valves. The coolant in the reactor is heated to become high temperature and high pressure hot water, then it passes through the steam generator. The heat is transferred from several thousand heat conducting pipes to the cold water circulating outside the pipes, then the water pump sends the coolant that has lost its heat back into the reactor for recycling and heating, forming a hermetic cycle.

The second circuit system is the steam circuit that converts the thermal energy of steam into electrical energy. It consists of a steam generator, a steam turbine, a condenser, a condensed water pump, a low pressure water feeder and heater, a water feeding pump and a high pressure water feeder and heater. The supply of water of the second circuit absorbs the heat of the first circuit in the steam generator and then becomes steam with a pressure of more than 50 atmospheric pressure units and a temperature of over 260 degrees Celcius. The steam is led into the steam turbine to work and drive the generator to generate electricity. Used steam is exhausted into the condenser to recondense it into water. The water then passes through the condensed water pump and the water feeder pump, and then it is sent to the low pressure and high pressure water feeder and heater. After initial heating, it is sent back to the steam generator so that it can again absorb heat to become steam.

The recycled water circuit consists of the recycling water pump and the condenser. The recycled water pump pumps river water to remove the heat in the condenser.

The first circuit system of a nuclear power plant is commonly called the "nuclear steam supply system." It is equivalent to the boiler system of ordinary thermal power plants but the technology is much more complex. The coolant that flows past the reactor may carry a certain degree of radioactivity, and this is more so when an element rod is damaged. In China's first nuclear power plant, the reactor, the steam generator, the main pump, the pressure stabilizer and such equipment which can carry radioactivity are placed centrally in one big hall. The hall is a huge cylindrical building with a hemispherical dome roof as a safety cap. The safety cap is made of reinforced concrete. In this way, even if a serious accident occurs at the nuclear power plant, radioactive materials can be completely sealed inside the safety cap and will not pollute the surrounding environment.

Safe, Reliable, and Clean Power Plant

The design of China's first nuclear power plant is extremely detailed and careful. A larger safety coefficient has been included in the design according to the principle of "not polluting national land, not endangering the people." The design has reduced the possibility of an accident to the minimum. There are also multiple and independent safety protection and control systems. When abnormalities occur during operation, they can sound an alarm and issue signals in time or can automatically and rapidly reduce the power and even execute an emergency shutdown of the reactor. When an accident occurs, effective measures can be taken to protect the reactor core so that it will not melt and the safety cap is guaranteed to remain intact. At the same time, effective measures have been established to prevent damage by various types of natural disasters such as earthquakes and floods. The reactor also has a strict dosage monitoring system and radiation protection. The treatment of the "three radioactive wastes" and the main construction project will be designed, constructed and begin operation simultaneously.

Because the reactor of China's first nuclear power plant has many layers of shields to prevent leakage of radioactivity, therefore it is very safe during operation.

The energy of nuclear fuel is very concentrated. All of the energy released by 1 kilogram of uranium-235 is equivalent to the thermal value of 2,500 tons of standard coal. China's first nuclear power plant uses a 3 percent low concentrate uranium oxide as fuel. The first load of the reactor will be about several dozen tons, later, one-third of it will be replaced each year, i.e., only some 10 tons. The nuclear fuel requires only several trucks to transport. When firing coal, such a large power station will have to consume 7 million tons of coal a year. Therefore, in our southeastern provinces which lack coal and electricity and where the population is large, building nuclear power stations is more beneficial. In the long-range view, nuclear power stations are also worthwhile economically.

9296
CSO: 4013/141

CONSERVATION

BRIEFS

CRUDE OIL CONSERVATION--Over the last 4 years, the Chinese petroleum refining industry has saved some 4.51 million tons of crude oil, an amount equal to the entire 1982 output of the Karamay Oil Field. Processed into high-grade gasoline, lubricating oil, and other petroleum products, the amount of petroleum saved translates into profits of 1.3 billion yuan. Today, each ton of crude processed by the industry consumes 80 kilograms of fuel oil, 25 percent less than /comparable figures for/ 1978, representing a level approaching that of the United States in 1981. /Text/ /Fuzhou FUJIAN RIBAO in Chinese 20 Feb 83 p 3/

CSO: 4013/166

END

END OF

FICHE

DATE FILMED

May 16, 1983